Part 5 Confined Spaces

Highlights

- The concept of a "restricted space" has been introduced to this Part.
- Section 44 requires employers to have a code of practice governing the practices and procedures for workers entering and working in a confined space. (Section 8 of the *OHS Regulation* requires that the procedures specified by a code of practice be in writing and available to workers.)
- Section 47 requires that employers establish an entry permit system for confined space entry.
- Section 52 requires continuous atmospheric monitoring of a confined space if there is a potential for the atmosphere to change unpredictably after a worker enters the confined space.
- Section 56 identifies the conditions under which an employer must provide a tending worker (trained in the evacuation procedures in the emergency response plan) at or near the entrance.

Requirements

Section 44 Code of practice

Confined spaces have a history of being potentially dangerous places to work as hazards within them are often magnified. Limited access may be combined with poor ventilation, hazardous surroundings or energized equipment. When workers unknowingly enter oxygen deficient or toxic atmospheres, the results can be fatal.

A code of practice describes the procedures to be followed to allow workers to safely perform work in a confined space. Section 8 of the *OHS Regulation* requires that the procedures be in writing and available to workers. The code of practice must include as topics the subject matter of each section of this Part, as well as hot work as described in section 169. Section 13 of the *OHS Regulation* requires that workers affected by the code of practice be familiar with it before work in the confined space begins.

Workers should be consulted about the content of the code of practice as they often have the best understanding of the hazards involved in the work. It may also help to ask for the help of safety professionals such as industrial or occupational hygienists or engineers, as some situations may be particularly complex.

The code of practice must be maintained and periodically reviewed to ensure that its procedures are up-to-date and continue to reflect the work activities for which they were originally written. The code of practice must also identify all existing and potential confined space work locations at a work site so that workers can be made aware of unexpected hazards and reminded that special safety requirements apply.

Working in a confined space is potentially one of the most dangerous of all workplace hazards. According to the New Zealand Department of Labour, working in a confined space is 150 times more dangerous than doing the same job outside the confined space.

A worker is considered to have "entered" a confined space when the worker's breathing zone crosses the plane of the confined space access.

Restricted and confined spaces

This edition of the OHS Code introduces the concept of a "restricted space". As discussed below, restricted spaces and confined space share certain common characteristics. They differ however in key areas that may help employers and workers to operate more safely and efficiently. Some employers and workers may eventually come to think of restricted spaces as "non-permitted confined spaces".

Restricted space explained

Like confined spaces, restricted spaces have a limited means of entry and exit. Entry points may not be designed for easy walk in. Other limitations include access by ladders or by stairways that provide poor access because of steep slope, narrow width or extreme length. Physical obstructions such as bulkheads, collapsed material, or machinery may impede exit. Limited means of entry and exit can make escape or rescue difficult.

A "restricted space" is an enclosed or partially enclosed space, not intended for continuous human occupancy that has a restricted, limited or impeded means of entry or exit because of its construction. It can be thought of as a work area in which the only hazard is the difficulty of getting into or out of the space. All other hazards are either non-existent or have been eliminated or controlled as required by Part 2. Restricted spaces are therefore not subject to the permitting, atmosphere testing and tending worker requirements of a confined space. Employers and workers must be

mindful that a restricted space can become a confined space if conditions or work practices change. Employers who voluntarily apply relevant sections of ANSI Z117.1-2003, *Safety Requirements for Confined Spaces*, might refer to restricted spaces as "non-permitted confined spaces".

Examples of a restricted space include
(a) an electrical or communication utility vault,
(b) a building crawl space,
(c) a trench with a temporary protective structure, and
(d) a deep excavation requiring ladder or lift access.

Despite being classified as a restricted space, the following requirements of Part 5 Confined Spaces, continue to apply to workers entering a restricted space:

- a hazard assessment must be performed prior to entry — section 45;
- workers assigned duties related to the entry must be trained to recognize hazards and how to perform their duties in a safe and healthy manner — section 46;
- general safety requirements involving the use and availability of safety, personal protective, and emergency equipment, as well as a communication system — section 48;
- prevention of unauthorized persons entering a restricted space — section 50;
- protection of workers from hazards created by traffic in the area of the restricted space — section 51;
- workers cannot enter or remain in a restricted space unless an effective rescue can be carried out — section 55;
- a competent worker, designated by the employer, must be in communication with the worker(s) inside a restricted space — section 56; and
- a safe means of entry and exit must be available to all workers required to work in the restricted space — section 57.

Confined space explained

As defined in section 1 of the OHS Code, a confined space is an enclosed or partially enclosed space that is not designed or intended for continuous human occupancy with a restricted, limited, or impeded means of entry or exit because of its construction and may become hazardous to a worker entering it because of
(a) an atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity,
(b) a condition or changing set of circumstances within the space that present a potential for injury or illness, or
(c) the potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

Confined spaces are not intended for continuous human occupancy. They are not sites of ongoing or regular work activity. They are usually entered only for such purposes as cleaning, inspection, maintenance, repair or construction. Figure 5.1 shows a flowchart that helps to determine if the space is a confined space or a restricted space.

Reasons for entering a confined space

Typical reasons for entering a confined space include:
(a) cleaning to remove sludge and other waste materials;
(b) inspecting process equipment;
(c) maintenance such as abrasive blasting and applying surface coatings;

(d) tapping, coating, wrapping and testing underground sewage, hydrocarbon, steam and water piping systems;
(e) installing, inspecting, repairing, and replacing, valves, piping, pumps, motors, etc. in below ground pits and vaults;
(f) checking and reading meters, gauges, dials, charts and other measuring instruments; and
(g) rescue of workers who are injured or overcome while inside the confined space.

In addition to other hazards, confined spaces may have limited means of entry and exit. This would not only make escape and rescue difficult, but could also restrict natural ventilation.

Types of confined spaces

Most confined spaces are designed to hold substances such as liquids, gases, and loose materials, or to house equipment. Though they come in many sizes and shapes, most can be classified in one of two ways:
(1) spaces that are open-topped and have depth — examples include pits, wells, vats, hoppers, bins, degreasers, and kettles; and
(2) spaces with narrow openings — examples include pipes, tunnels, silos, casings, and sewers.

Confined spaces may have poor natural ventilation and contain, or have the potential to contain, an atmosphere that is unsafe. Poor ventilation can be the result of unpredictable or limited air movement, or natural air currents that could draw contaminated air into the space. While unsafe atmospheres are most commonly associated with spaces that are fully enclosed, vats, pits and vessels that are open-topped can also contain an unsafe atmosphere. In these cases, the unsafe atmosphere results from the entry of a gas that is heavier than air, the release of gas resulting

from wastes at the bottom of the space being disturbed, or the presence of a layer of air above the space that prevents fresh air from moving into it.

Confined spaces can become unsafe as a result of

(1) atmospheric contamination by toxic substance (a concentration of a substance above the regulated exposure levels or otherwise known as safe levels) or flammable vapours, or oxygen deficiency (less than 19.5 percent oxygen by volume) or excess (more thatn 23.0 percent oxygen by volume);
(2) physical hazards i.e. electrical, thermal, radiological, noise, engulfment, etc.
(3) liquids, gases, or solids being introduced to the space during occupancy.

Some confined spaces become unsafe as a result of the conditions or work that is done inside them. Examples of conditions that can make a confined space unsafe are:

(a) manholes in contaminated ground e.g. near a leaking underground gasoline storage tank, into which poisonous or flammable gases can seep;
(b) manholes, pits or trenches connected to sewers, in which there can be a build-up of flammable and/or poisonous gases and/or insufficient oxygen in the air;
(c) tanks or pits containing sludges and other residues which, if disturbed, may partially fill the confined space with dangerous gases; and
(d) confined spaces that contain rotting vegetation, rusting metal work, and similar natural oxidation processes that create an oxygen-deficient atmosphere.

Some examples of confined spaces in which changing conditions or activities being done can make the space unsafe are:

(a) some painting work and the application of certain adhesives, cleaners and liquids such as paint thinners. These can produce dangerous amounts of solvent vapour, which can cause dizziness and impair judgment. Such solvents are often flammable so there is an accompanying risk of fire;
(b) welding activities may generate toxic gases or vapours; and
(c) the use of gasoline or diesel engines can lead to the build-up of poisonous carbon monoxide gas. There is also a risk of fire resulting from leaks; and
(d) introduction of hot work.

In some cases a confined space can become unsafe because of the inherent characteristics of activities that may occur external to the space. Examples include:

- the filling/emptying of an adjacent compartment/tank;
- weather changes, such as thunderstorms i.e. a drop in barometric pressure, lightning, etc.;
- heat of the day increasing vapourization and affecting personnel i.e. heat exhaustion; and
- pipelines entering the confined space may contain hazardous materials.

Table 5.1 lists examples of confined spaces by industry.

Table 5.1 Examples of confined spaces by industry

Construction Industry	**Textiles**	**Petroleum and Chemicals**	**Fabricated Metals**
Sewers	Bleaching ranges	Reactors	Paint dip tanks
Unprotected excavations	J-boxes	Storage tanks	Degreasers
	Kiers	Distillation columns	Caustic cleaning tanks
Food and Similar Products	Die kettles	Cooling towers	Drying ovens
Retorts	Bale presses	Dike areas	Shot blasting enclosures
Tubs and kettles	Dye becks	Fire water tanks	Enclosed assemblies
Basins	Sizing tanks	Precipitators	Sludge tanks
Cold rooms	Steam boilers	Scrubbers	
Ovens		Crystallizers	**Machinery**
Flour bins	**Paper and Pulp**	Spray dryers	Boilers
Air scrubbers	Chip bins		Conveyors
Batch cookers	Barking drums	**Leather Products**	Dust collectors
Caustic soda tanks	Rag cookers	Dye vats	Tunnels
Clay hoppers	Acid towers	Tanning tanks	
Conditioners	Digesters	Sludge pits	**Electronic Industry**
Continuous cookers	Beaters		Degreasers
Extractors	Hydropulpers	**Stone, Clay, Glass and Concrete Products**	Gas cabinets
Heated lard tanks	Stock chests		Plating/rinse tanks
Heated sugar bins	Adhesive tanks	Kilns	
Holding bins	Bleach tanks	Aggregate bins	**Electric, Gas and Sanitary Services**
Hydrogenators	Chip silos	Cement silos	
Metal bins	Furnaces	Crushers	Cable vaults
Meal dryers	Machine chests	Dryers	Manholes
Mixers	Mix tanks	Hoppers	Meter vaults
Tallow tanks	Resin tanks	Mills	Transformer vaults
	Clay mix tanks	Sand bins	Bar screen enclosures
			Chemical pits
	Printing and Publishing	**Primary Metals**	Incinerators
	Ink tanks	Blast furnaces	Pump stations
	Solvent tanks	Cupolas	Regulators
		Coal bins	Sludge pits
	Rubber Products	Coke bunkers	Wet wells
	Solvent tanks	Annealing furnaces	Valve pits
	Shredders	Slag pits	Digesters
	Furnaces	Water treatment tanks	Grease traps
	Ovens	Submarine cars	Lift stations
	Mixers	Gas holders	Sewage ejectors
		Soaking pits	Storm drains
		Acid pickling tanks	
		Plating tanks	

Based on similar table in:
Rekus JF. *Complete Confined Spaces Handbook*. National Safety Council, Lewis Publishers, Ann Arbor; 1994

For more information:

http://employment.alberta.ca/documents/WHS/WHS-PUB_cs001.pdf
Guideline for Developing a Code of Practice for Confined Space Entry

http://www.osh.dol.govt.nz/order/catalogue/pdf/confined.pdf
Safe Working in a Confined Space

http://www.setonresourcecenter.com/safety/publications/confined/2864_confined.pdf
They're Not Designed to be Occupied!

Rekus JF. *Complete Confined Spaces Handbook*. National Safety Council, Lewis Publishers, Ann Arbor; 1994.

Section 45 Hazard assessment

Restricted spaces have a limited means of entry and exit. Entry points may not be designed for easy walk in. Other limitations include access by ladders or by stairways that provide poor access because of steep slope, narrow width or extreme length. Physical obstructions such as bulkheads, collapsed material, or machinery may impede exit. Limited means of entry and exit can make escape or rescue difficult.

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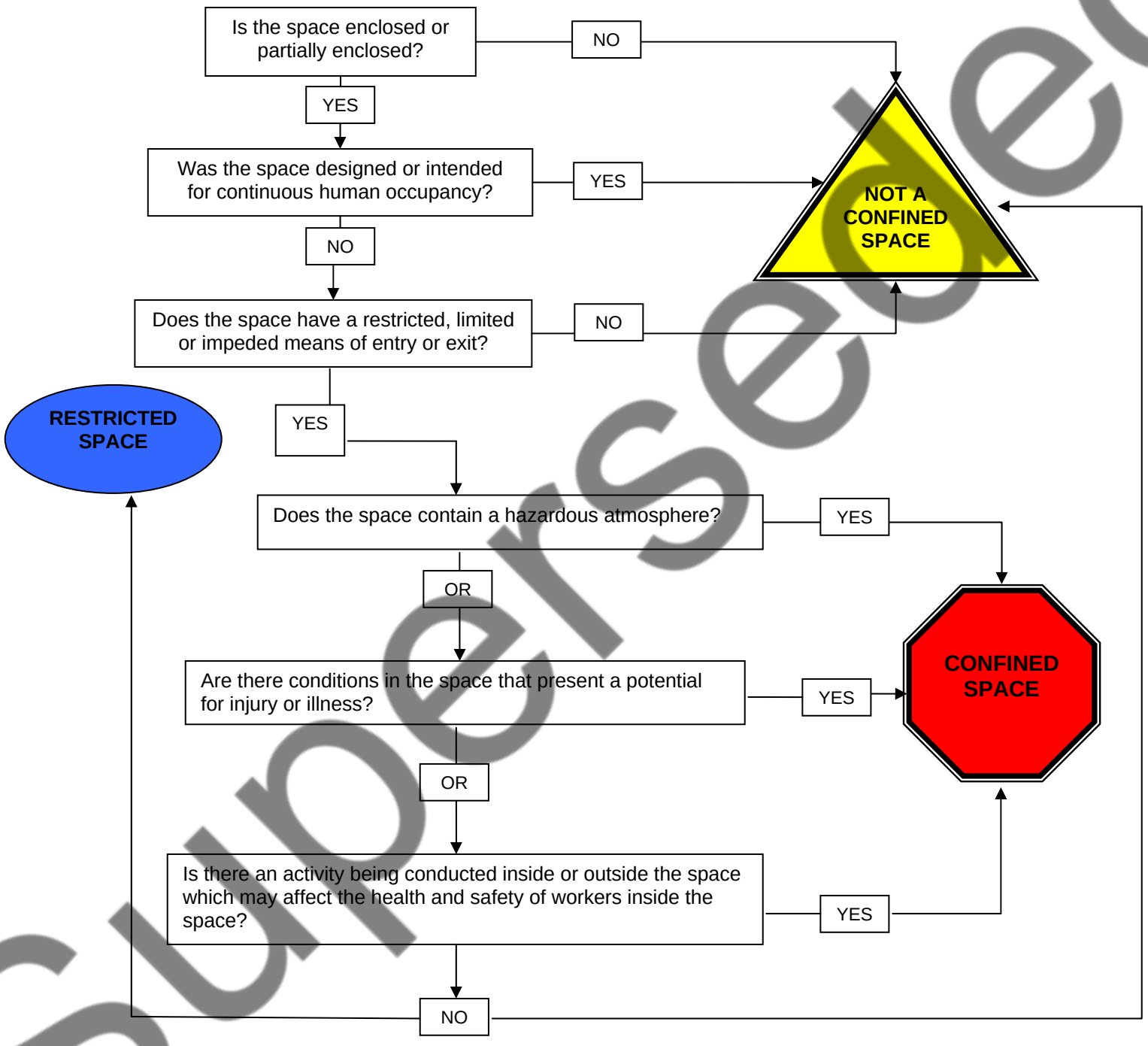
- a competent worker, designated by the employer, must be in communication with the worker(s) inside a restricted space — section 56; and
- a safe means of entry and exit must be available to all workers required to work in the restricted space — section 57.

If a worker enters a confined or restricted space to work, the employer must appoint a competent person to carry out the tasks listed in this section. The competent person must be knowledgeable about confined or restricted spaces and capable of carrying out each of the listed activities.

Figure 5.1 shows a flowchart that helps to determine if the space is a confined space or a restricted space.

Figure 5.1 Flowchart to determine type of space



In assessing the hazards that workers are likely to be exposed to, the requirements of Part 2 of the OHS Code – Hazard Assessment, Elimination and Control – must be met. The hazard assessment needs to be revised whenever there is evidence to indicate that it is no longer valid and when any of the conditions listed in subsection 7(4) of the OHS Code is met.

Some of the hazards of confined spaces include:

(a) *oxygen deficient atmospheres* – can cause brain damage and death. Oxygen deficiency can be caused by rusting (or oxidation) of a steel vessel, any form of burning, including welding or brazing, absorption by grain or soils, consumption by bacteria that can use up some or all of the oxygen in the space;

(b) *asphyxiant gas* – physiologically inert gases can dilute or displace atmospheric oxygen below the level required for normal human functioning. Common examples of asphyxiant gases are carbon dioxide, ethane, helium, hydrogen, methane and nitrogen. During a process known as purging, an inert gas such as nitrogen is deliberately pumped into a confined space to purge or force out flammable or explosive atmospheres from a confined space. The inert gas is usually replaced with fresh air before the space is safe to enter;

(c) *toxic atmospheres* – containing gases, vapours, dusts or fumes that have poisonous effects on the body. Cleaning, painting or welding may produce dangerous vapours or fumes. Gases such as hydrogen sulphide may leak into the space from gas pockets underground. Carbon monoxide may be generated in the space by an internal combustion engine. Methane may be created through the fermentation of plant material in the space;

(d) *flammable or explosive atmospheres* – containing flammable gases, vapours or dusts that could be ignited by a spark or open flame. The risk of explosion increases if an oxygen-enriched atmosphere is present i.e. if the oxygen content is greater than 23 percent by volume;

(e) *engulfment* – workers can be trapped or buried by dry bulk materials such as grain, sand, flour, fertilizer and sawdust;

(f) *operation of moving parts* – being trapped or crushed by augers, mixers, agitators, conveyor belts, etc. This equipment must be locked out before anyone enters the confined space;

(g) *uncontrolled introduction of steam, water or other gas or liquid;*

(h) *other hazards* – these could result from the work being done e.g. noise, extremes of temperature, radiation, manual handling and falls.

Section 46 Training

Subsection 46(1)

All workers who work within confined or restricted spaces and all workers with related duties e.g. rescue workers and tending workers or "safety watch" personnel, must receive training specific to confined or restricted spaces. Every worker who works in a confined or restricted space must be able to recognize the hazards of working in the space and safely perform assigned duties. The rescue portion of this training may be part of a company or operation-wide emergency preparedness and response plan.

Training on its own does not ensure that a worker is competent to safely perform work. In addition to training, a worker must be adequately qualified and experienced to work safely. In cases where a worker is new to the job and does not have sufficient experience, the worker must be teamed up with and work under the direct supervision of a competent worker.

Subsection 46(2)

Records of confined or restricted space training must be retained for as long as the worker in question is expected to perform work within confined or restricted spaces. If a worker changes responsibilities and no longer enters confined or restricted spaces as part of his or her work, the confined or restricted space training records for that worker are no longer required.

Subsection 46(3)

Whatever the combination of personnel responding to an emergency, all of the skills listed must be represented among the members of the rescue team. The required skills can be held by only one member of the rescue team, or shared among as many members as is necessary.

Section 47 Entry permit system

A confined space entry permit is essentially a document that sets out the work to be done and the precautions to be taken. In some ways it functions as a safety checklist to make sure that nothing is overlooked. Figure 5.2 shows an example of a typical confined space entry permit.

The entry permit must, at a minimum
(a) list the name of each worker who enters the confined space and the reason for their entry,
(b) provide the location of the confined space,
(c) specify the time period for which the entry permit is valid,
(d) take into account the work being done in the confined space, and therefore the safety precautions that must be taken, and
(e) take into account the code of practice requirements for entering, being in and leaving the confined space.

The completed permit must be kept readily available. In some situations and circumstances, better practice is to have the permit posted at each entry point into the confined space.

An entry permit will cover a specific task or project, which may occur over a number of shifts. The time for which the entry permit is valid is based on the estimated time to complete the project's work activities and must be identified on the permit. An entry permit should be treated as expired sooner than the stated expiry time if one of the following occurs:
(a) the confined space is returned to service,
(b) continuity of responsible supervision for the confined space is broken, or
(c) the task or project is interrupted for a significant time because of an emergency that affects the confined space, e.g. an incident, rescue or a breakdown of engineering control equipment.

Once an entry permit has expired, a new permit must be issued before entry into the confined space is allowed.

If an employer performs a hazard assessment of a representative sample of identical confined spaces, then a single entry permit can be used for these and any additional identical confined spaces. Readers are referred to the explanation of section 45 for further information.

An entry permit is not required for restricted spaces.

Figure 5.2 Example of typical confined space entry permit

CONFINED SPACE ENTRY PERMIT

Permit number _____ Date: _____

Location and Description of Confined Spaces

_____

_____

Purpose of Entry

_____

_____

Scheduled Start _____ a.m. p.m.
Day Date Time

Scheduled Finish _____ a.m. p.m.
Day Date Time

Worker(s) in charge of entry:

Entrants

_____

_____

Attendants

_____

_____

Pre-Entry Authorization (Check those items below which are applicable to your confined space entry permit)

- ☐ Oxygen-Deficient Atmosphere
- ☐ Oxygen-Enriched Atmosphere
- ☐ Welding/cutting
- ☐ Engulfment
- ☐ Toxic Atmosphere
- ☐ Flammable Atmosphere
- ☐ Energized Electric Equipment
- ☐ Entrapment
- ☐ Hazardous Chemical

SAFETY PRECAUTIONS

- ☐ Self-Contained Breathing Apparatus
- ☐ Air-Line Respirator
- ☐ Flame Resistant Clothing
- ☐ Ventilation
- ☐ Protective Gloves
- ☐ Linelines
- ☐ Respirators
- ☐ Lockout/Tagout
- ☐ Fire Extinguishers
- ☐ Barricade Job Area
- ☐ Signs Posted
- ☐ Clearance Secured
- ☐ Lighting
- ☐ Ground Fault Interrupter
- ☐ Remarks _____

ENVIRONMENTAL CONDITIONS

Tests to be taken	**Date/Time**	**Re-Testing**	**Date/Time**
Oxygen _____ %	_____ a/p	Oxygen _____ %	_____ a/p
Lower Explosive Limit _____ %	_____ a/p	Lower Explosive Limit _____ %	_____ a/p
Toxic Atmosphere _____		Toxic Atmosphere _____	
Instruments Used _____		Instruments Used _____	

Worker conducting safety checks **signature** _____

Remarks on the overall condition of the confined space: _____

_____

☐ **ENTRY AUTHORIZATION** – All actions and/or conditions for safe entry have been performed

Person in charge of entry _____
Please print

☐ **ENTRY CANCELLATION** – Entry has been completed and all entrants have left the space

Person in charge of entry _____
Please print

Section 48 Safety and protection — generally

An employer must ensure that all equipment to safely perform confined or restricted space work, including personal protective equipment and rescue equipment, is available and inspected to ensure it is in good working order. All workers must follow the code of practice for confined space and use the equipment as necessary to protect their health and ensure their safety.

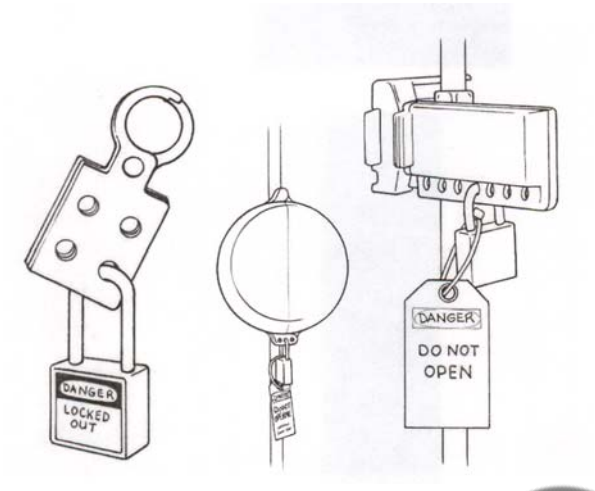
Lifelines can present a danger if they get tangled around equipment or wrapped around a protrusion in a confined or restricted space. Lifelines, in the event that they are required, may only be used in a manner that does not endanger a worker by creating another hazard.

Workers within a space must be able to effectively communicate amongst themselves (where necessary) and communicate with workers outside the confined or restricted space using a system that is appropriate to the hazards within the confined or restricted space e.g. communication equipment that functions in the presence of hazardous gases.

Section 49 Protection — hazardous substances and energy

When a worker is in a confined space, uncontrolled energy sources and hazardous substances must be prevented from creating a hazard to workers. Examples of appropriate controls include blanking or blinding, double blocking and bleeding, misaligning or removing sections of lines, pipes or ducts, controlling all sources of hazardous energy, de-energizing equipment and immobilizing or disconnecting all mechanical linkages (see Figure 5.3). In certain cases, alternate means of isolation and safe work procedures, certified by a professional engineer, may be used to protect workers.

Figure 5.3 Methods of controlling hazardous energy



Blanking involves inserting a physical barrier through the cross-section of a pipe so that materials are prevented from flowing past that point (see Figure 5.4). Blinding involves disconnecting a pipe and attaching a physical barrier to its end so that materials are prevented from flowing out of the pipe. Double blocking and bleeding involves use of a three-valve system where a pipe has two closed valves and an open drain valve positioned between them so that material is prevented from flowing and is re-directed in case of a valve leak (see Figure 5.5). The valves of a double block-and-bleed system need to be locked to ensure an acceptable level of safety.

Figure 5.4 Example of blanking

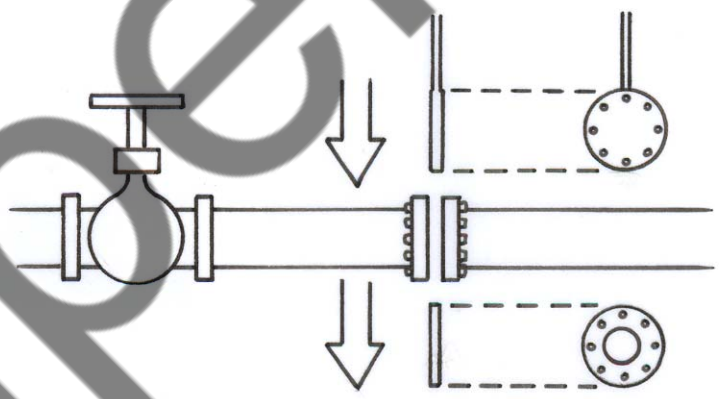
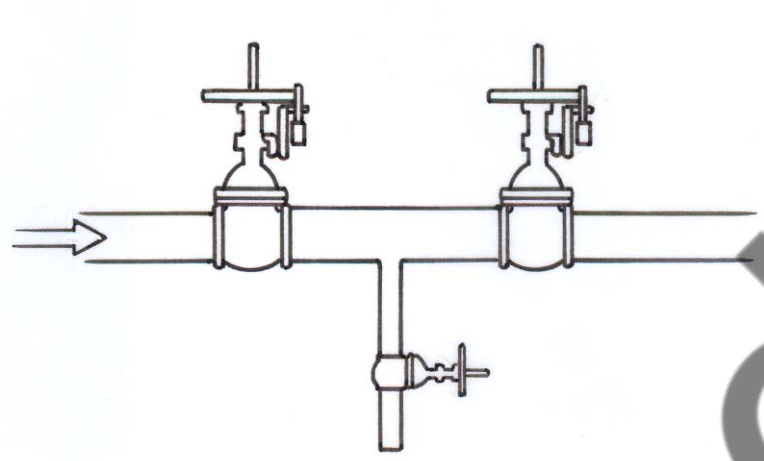


Figure 5.5 Example of a double bock and bleed



Special care must be taken to ensure that workers are protected against drowning, engulfment, entrapment or other hazards presented by free-flowing material(s) that may be encountered within a confined space. In some circumstances for example, a full body harness and lifeline system may be needed. See Table 5.2 for a list of common non-atmospheric hazards.

Table 5.2 Common non-atmospheric hazards

Common non-atmospheric hazards		
Hazard	How it occurs	Why you should be concerned
Engulfment	Loose material drawn from the bottoms of storage bins can suffocate or bury an entrant. Liquids or materials are suddenly released into the space.	Liquid or loose materials can trap or bury a worker in seconds.
Mechanical and hydraulic energy	Mechanical and hydraulic equipment start or move unexpectedly.	Entrants servicing mechanical and hydraulic equipment can be seriously injured or killed if the energy isn't properly controlled.
Noise	Confined space can amplify sounds produced by tools and equipment.	Noise interferes with essential communication between entrants and attendants.
Falling objects	Objects fall into the space because topside openings are unguarded or improperly guarded.	
Extreme temperatures	The space's location and the equipment it contains make it very hot or cold.	Hot environments put workers at risk for heat stress, especially if they are doing strenuous work or wearing protective clothing — cold environment make tasks more difficult to accomplish.
Slippery surfaces	Leaks, spills and condensation make walking surfaces slippery.	Wet surfaces are usually slippery. They increase the risk of falls.
Corrosive chemicals	Corrosive chemicals are stored in the space, or entrants use them to do tasks.	Corrosive chemicals can cause severe eye or skin irritation if exposed workers are not wearing protective clothing.
Access problems	Confined spaces are difficult to enter and exit.	In an emergency, entrants may not be able to exit quickly.
Illumination problems	Most confined spaces are dark places.	Poor lighting makes it difficult for workers to enter, exit, and work in a confined space.

Section 50 Unauthorized entry

Only persons with a reason for being in a confined or restricted space are allowed to be there. Persons who are not authorized by the employer to enter a confined or restricted space must be prevented from entering.

Section 51 Traffic hazards

Workers within a confined or restricted space must be protected from traffic hazards such as idling vehicles situated outside the space that could contaminate the space with exhaust, lift trucks that could damage rescue equipment, or moving vehicles around manhole areas that could interfere with worker safety.

Section 52 Testing the atmospheric

Before entering a confined space that may contain a hazardous atmosphere e.g. oxygen deficient or containing toxic or explosive substances, pre-entry atmospheric testing must be done to ensure that levels of oxygen are adequate and that any hazardous substance is identified (see Figure 5.6). Competent workers must conduct the testing with suitable test equipment that has been properly calibrated and is used in accordance with the manufacturer's specifications. It is particularly important for the individuals performing these tests to understand the limitations of the test equipment.

Figure 5.6 Atmospheric testing

After initial tests have been completed and workers are working within a confined space, periodic testing must be conducted as often as necessary to ensure the health and safety of the workers inside. The intervals at which periodic testing should occur depend on the outcome of the hazard assessment, the work being performed in the space, and the likelihood of the atmosphere changing substantially.

Situations may arise in which the atmosphere within a confined space, or the concentration of an airborne substance(s) within a confined space, can change unpredictably. If the hazard assessment identifies the potential for such a situation, then continuous atmospheric monitoring is required.

If tests identify additional hazards that were not identified in the original hazard assessment, these hazards must be addressed as required by the OHS Code. The resulting procedures and practices must be included in the code of practice so that the code of practice is complete and deals with all identified hazards.

All test results must be recorded. Employers have the option of conventional hard copy recording on paper or through some means of electronic data logging. See Table 5.3 for a list of common atmospheric hazards.

Section 53 Ventilation and purging

Ventilating means the use of mechanical ventilation to force fresh air into the confined space while workers are working. Purging means the introduction of substances such as an inert gas, steam or water into a confined space to displace or flush out contaminants prior to workers entering the space.

If atmospheric testing identifies that a hazardous atmosphere is present or is likely to be present in a confined space, the space must be ventilated, purged or both before a worker enters the confined space. If ventilating or purging is impractical or does not eliminate the atmospheric hazards, workers are then required to wear appropriate personal protective equipment. Personal protective equipment is not an acceptable method of worker protection from flammable or explosive atmospheres.

If mechanical ventilation is required to maintain a safe work atmosphere within a confined space, the employer must ensure that the ventilation system incorporates a method of alerting workers if the system fails. Workers must be trained in the evacuation procedures to be used if the ventilation system fails.

Table 5.3 Common atmospheric hazards

Common atmospheric hazards		
Hazard	How it occurs	Why you should be concerned
Oxygen deficiency (less than 19.5 percent oxygen)	Chemical or biological reactions consume oxygen.	Oxygen-deficient atmospheres affect heart rate, muscle coordination, and breathing. Eventually, they lead to death.
Oxygen enrichment (greater than 23.0 percent)	Results from welding tasks and from the improper use of oxygen for breathing air.	Oxygen-enriched atmospheres increase the risk of fire or explosions.
Flammable atmospheres	Fuel, oxygen, and a source of ignition cause fires and explosions.	Flammable gases such as acetylene, butane, propane, hydrogen, and methane are often common in confined spaces. Grain, nitrated fertilizers, and ground chemicals can produce combustible dusts.
Toxic atmospheres	Accumulates through some manufacturing, biological, or chemical reactions. Released during work or tasks such as welding and cleaning.	Many manufacturing processes, stored materials, and work tasks produce toxic gases, vapours, or dusts.
Corrosive atmospheres	Accumulates from some manufacturing processes, biological or chemical reactions.	Corrosive substances destroy living tissue. Some cause immediate damage to skin and eyes; some have no immediate effect, but cause cancer with prolonged exposure.

Section 54 Inerting

Inerting means the introduction of an inert (unreactive) gas such as nitrogen into a confined space to completely displace all oxygen.

For a flammable mixture to burn or explode, a source of oxygen and a source of ignition are required. Inerting is a technique that is used to remove air and the oxygen that it contains. This creates an oxygen-deficient atmosphere and workers who enter the space must be properly trained and equipped with self-contained breathing apparatus, self-contained oxygen generating apparatus or supplied-air breathing apparatus with an emergency escape bottle.

Care must be taken to ensure that the atmosphere remains inerted while workers are within the confined space. To ensure an additional level of safety, all ignition sources must be controlled so that they cannot trigger a fire or explosion. See Part 10 of the OHS Code for requirements dealing with fire and explosion hazards.

Section 55 Emergency response

Before work in a confined or restricted space is allowed, the employer must have an effective emergency response plan in place. In the event of an emergency, workers must be able to carry out an effective rescue and workers must be able to immediately evacuate a confined or restricted space if conditions warrant.

Comments on the use of 911 for rescue

In the case of rescues involving workers in confined spaces and workers suspended in the air after a fall, calling 911 alone and awaiting the arrival of rescue services personnel is considered to be an insufficient emergency response. The employer must have some basic level of on-site rescue capability- see this section for confined spaces and section 140 for fall protection – in the event that rescue services personnel are delayed or unable to attend the scene.

In some situations, rescue services personnel may not have the equipment or skills to perform a rescue e.g. a worker in a confined space deep below ground level in a horizontal tunnelling operation or a worker suspended 100 metres above ground level following the failure of a swingstage scaffold. In such cases, the employer's on-site rescue capability must be such that the work site is virtually self-sufficient in returning a rescued worker to the surface or ground level.

Section 56 Tending worker

With proper communication, work in a confined or restricted space is made easier, safer and in many cases, more productive. Care must be taken when selecting communication equipment for this unique work environment. Confined or restricted spaces are very different from any other work area and must be treated accordingly.

Radio signals do not penetrate metal or concrete reinforced with re-bar, which describes a majority of confined or restricted space environments, creating dead spots or reducing signal strength. Messages can become garbled or are not received. This prevents continuous communication in certain types of spaces.

Radio equipment is extremely effective when used by safety attendants outside spaces to maintain contact with their base or, in the event of a problem, to call for rescue assistance.

The preferred choice for reliable communication in confined or restricted spaces is a hard-line full duplex system, which allows hands-free communication between a tending worker and workers inside the space.

No matter which method of communication is chosen, the equipment selected should be suited to the particular work environment. It should be extremely rugged, resistant to chemicals, environmentally sealed and intrinsically safe if used in a potentially hazardous location.

As required by subsection (3), a tending worker – a competent worker trained in the evacuation procedures in the emergency response plan and who is present outside the confined space, at or near the entrance – is required under the following four conditions:

(a) the oxygen content of the atmosphere inside the confined space is less than 19.5 percent by volume;
(b) the oxygen content of the atmosphere inside the confined space is greater than 23.0 percent by volume;
(c) the concentration of a substance listed in Table 2 of Schedule 1 inside the confined space is greater than 50 percent of its occupational exposure limit; or
(d) a hazard other than one listed in clauses (a), (b) or (c) is identified by the hazard assessment and the hazard cannot be eliminated or effectively controlled.

The role of the tending worker is to monitor the safety of the person(s) working inside the confined space and to take action if an emergency arises. This tending worker must

(a) keep track at all times of the number of workers inside the confined space,
(b) be in constant communication with the workers inside the confined space,
(c) have a suitable system for summoning assistance, and
(d) not leave the area until all workers have left the confined space or another tending worker is in place.

If the four conditions listed above do not apply to a particular confined space, then a tending worker as described above, having the duties described above, is not required. Instead, as required by subsections 56(1) and 56(2), a competent worker designated by the employer must be in communication with the worker in the confined space. In some cases this designated worker may be in a nearby vehicle, or may be at a central dispatch location. The competent worker designated by the employer must have a suitable system for summoning assistance in the event of an incident or emergency.

Section 57 Entry and exit

A safe means of entry and exit, free from traffic hazards, must be provided for all confined or restricted space workers and rescue personnel. For example, secured steps, temporary platforms and handrails may be suitable in certain circumstances.

Section 58 Retaining records

The employer must retain records of entry permits, air monitoring data, worker entry records and other applicable information related to each confined space entry for the periods specified.