G9.34-1 General requirements for a stand-by person

Issued August 1, 1999

Sections 9.34 to 9.36 of the *OHS Regulation* require that, whenever a worker enters a confined space, another worker or workers must be assigned as the standby person(s). The positioning and functions of the standby person differ, depending on whether the atmosphere in the confined space has been determined through the hazard assessment under section 9.9 to be low, moderate or high.

Depending on the rescue procedures, a stand-by person may also be trained and serve as a rescue person for the purpose of sections 9.37 to 9.41(3) of the *OHS Regulation*. In accordance with section 9.41(3), the stand-by person may not enter the space to effect rescue until at least one other worker is present and prepared to render assistance to the rescue worker.

G9.34-2 Stand-by person for a low hazard atmosphere space

Issued August 1, 1999

The requirement for low hazard atmosphere confined spaces in section 9.34 allows the stand-by worker to effectively serve as a person-check for a worker working alone in the space. The standby person does not have to be located at or near the entrance to the space if there is a "continuous means of summoning the standby person". However, the standby person cannot be located inside the confined space. The stand-by person must check on the well being of the worker inside the confined space every 20 minutes or more frequently if required by the entry procedures.

G9.35 Stand-by person for a moderate hazard atmosphere space

Issued August 1, 1999

A moderate hazard atmosphere confined space requires a stand-by person to be located at or near the entrance. At least every 20 minutes, the standby must visually observe or otherwise check the well being of the workers in the space. The standby can have other duties if they do not interfere with the standby person remaining at or near the entrance to the space, or interfere with the checking of workers in the space. See also OSH Guideline G9.34-1.

G9.36 Stand-by person for a high hazard atmosphere space

Issued August 1, 1999

A high hazard atmosphere confined space requires the stand-by person to be stationed at the entrance to the space and dedicated to the task of monitoring the workers in the space. The standby worker cannot have other duties. See also OHS Guideline G9.34-1.

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G9.18 Control of harmful substance in adjacent piping

Issued April 9, 2008; Editorial Revision to include February 1, 2011 regulatory amendment; Editorial Revision June 29, 2017

Regulatory excerpt
Section 9.18 (Control of harmful substance in adjacent piping) of the *OHS Regulation* ("*Regulation*") states:

> (1) Before a worker enters a confined space where adjacent piping contains a harmful substance that is
>
> (a) a liquid with sufficient volatility to produce a hazardous concentration of an air contaminant, or
>
> (b) a gas or vapour,
>
> the harmful substance in the adjacent piping must be controlled by either disconnecting the adjacent piping or isolating it using blanks or blinds that meet the requirements of section 9.20.
>
> (2) Subject to subsection (3), before a worker enters a confined space where adjacent piping contains a harmful substance that is neither
>
> (a) a liquid with sufficient volatility to produce a hazardous concentration of an air contaminant, nor
>
> (b) a gas or vapour,
>
> the harmful substance in the adjacent piping must be controlled by either disconnecting the adjacent piping or isolating it using blanks or blinds that meet the requirements of section 9.20 or using a double block and bleed system that meets the requirements of section 9.21.
>
> (3) Before a worker enters a confined space where adjacent piping contains a substance that is harmful only because of the temperature, pressure or quantity of the substance, the harmful substance must be controlled

(a) by either disconnecting the adjacent piping or isolating it using blanks or blinds that meet the requirements of section 9.20 or using a double block and bleed system that meets the requirements of section 9.21,

(b) by isolating the adjacent piping in a manner that a professional engineer has certified will make the confined space safe for a worker to carry out the intended work, or

(c) if there is no head pressure in the adjacent piping, by de-energizing and locking out each pressure source for the adjacent piping and depressurizing the adjacent piping.

(4) Where a confined space is

(a) subject to the ingress of gases from a gravity-flow municipal or domestic sanitary sewer system or storm sewer system, and

(b) protected from the ingress of gases by a p-trap,

a worker may enter the confined space only if the atmosphere of the confined space has been tested immediately before entry and the test results confirm that the confined space contains clean respirable air.

(5) If a worker enters a confined space of the type referred to in subsection (4), the following must be undertaken:

(a) the operational integrity of the p-trap must be confirmed immediately on the entry of the worker;

(b) while the worker is inside the confined space, the atmosphere of the confined space must be continuously monitored and confirmed to contain clean respirable air.

Purpose of guideline
Section 9.18 of the *Regulation* addresses the isolation of harmful substances that exist in adjacent piping. Isolation is intended to address hazards arising from fluids (typically liquids, vapours, and gases) and other flowable materials such as slurries, dust, and powders.

This guideline clarifies when section 9.18 applies, and provides interpretive information for each of its subsections.

Adjacent piping
The definition of adjacent piping in section 9.1 of the *Regulation* is

> *"adjacent piping"* means a device such as a pipe, line, duct or conduit which is connected to a confined space or is so located as to allow a substance from within the device to enter the confined space;

Under this definition there are two general types of adjacent piping.

- Piping that is "connected to a confined space," which is piping that has openings in the space creating the possibility of emptying its contents into the confined space.

- Piping that is not physically connected to the confined space but may be located nearby in a manner that could allow a substance from the piping to enter the space. An example would be a bleed pipe that may dump contents onto a drain that leads to a pipe connected to the confined space.

Under the definition there are two types of circumstances where piping or conduit in or near a confined space is not adjacent piping.

- *A piping system that passes through the confined space*: Such piping would not be considered to be adjacent piping if it is designed and maintained so there are no openings or other locations in the piping where leakage may occur, and work on or around the piping will not cause leakage. In such cases, measures must be adopted under section 9.4 (Control of hazards) to ensure worker safety when working in proximity to the piping. If any work in the space may result in leakage, then the piping must be treated as adjacent piping, in which case the control measures under section 9.18 apply. Leakage could occur for example, during a repair to a piping connection or replacement of a valve stem gland.

- *Orifices between spaces*: In some configurations there are adjacent spaces with one or more orifices in a common wall between them. Section 9.18 is based on the use of control measures such as blanks, blinds, disconnects, and double block and bleed devices. A wall between two spaces is typically of a width and configuration that the use of such devices is not possible. As such, an orifice in a wall between a confined space and another space is not adjacent piping. Therefore, the blank, disconnect, double block and bleed, and blind requirements do not apply.

  However, the employer must ensure that workers are protected against any hazards associated with orifices under other provisions such as section 9.4 (Control of hazards). The application of section 9.4 means that the potential for fluid discharge into the confined space must be controlled so that the hazards to workers are eliminated or minimized.

  Examples of controls might include a gate over the orifice designed to prevent any leakage and secured in place so that it could not be dislodged from the closed position. For fluids that do not pose a vapour or gas hazard it may be appropriate to use a device to control fluid level in one of the spaces so that it does not rise to and flow through an orifice into the confined space where workers are present.

In the remainder of this guideline the isolation measures permitted under the various provisions of section 9.18 are described. Section 9.18(1) provides for the most general circumstances for adjacent piping and the subsequent subsections provide for more specific circumstances.

Application of section 9.18(1) - Basic isolation options
This provision specifies three basic options for isolating adjacent piping: disconnection, blanks, and blinds.

1. Disconnection: Disconnecting is defined in section 9.1 of the *Regulation* as follows:
   "disconnecting" means physically disconnecting adjacent piping from a confined space to prevent its contents from entering the space in the event of discharge;
   For example, if a pipe is disconnected, either a length of the pipe at least 10 times its diameter should be removed or the open ends of the disconnected pipe should be moved out of line so that leaks will not bypass the disconnection and continue into the confined space. In any disconnect procedure the requirements of the *Regulation* related to the protection of workers from contents of the piping must be complied with.

2. *Blanking and blinding*: Blanks and blinds are defined in section 9.1 of the *Regulation* as follows:

   "blank" means a solid plate installed through the cross-section of a pipe, usually at a flanged connection;

   "blind" means a solid plate installed at the end of a pipe which has at that point been physically disconnected from a piping system;

   "blanking or blinding" means the absolute closure of adjacent piping, by fastening across its bore a solid plate or cap that completely covers the bore and that is capable of withstanding the maximum pressure of the adjacent piping;

   The goal of a blank or blind is to eliminate any possibility of fluid entering a confined space. Since a conventional blank bisects flanges, if any fluid leakage were to occur it would discharge directly into the atmosphere. Fluid leakage cannot be allowed to pressurize an enclosed area, resulting in the possible entry of leakage into the downstream portion of the pipe. Requirements for blanks and blinds are specified in section 9.20 and described in the WorkSafeBC publication *Confined Space Entry Program: A Reference Manual*.

Application of section 9.18(2) - Harmful substances that are not volatile liquids, gases, or vapours
This provision applies to substances in adjacent piping that cannot result in worker exposure to a gas or a vapour in the confined space. For this circumstance, another isolation measure is permissible - a double block and bleed system. This provision involves closing valves in the piping by locking out a drain or vent valve in the open position in the line between two valves that are locked out in the closed position. Requirements for a double block and bleed system are specified in *Regulation* section 9.21 and described in *Confined Space Entry Program: A Reference Manual*.

Application of section 9.18(3) - Materials hazardous only because of pressure, temperature, or quantity
This provision applies to materials that are not toxic or corrosive, and are harmful only because of pressure, temperature, or quantity. Typically this requirement applies to systems carrying water or steam. Three isolation options are outlined in the *Regulation*.

1. *Controls meeting the requirements of section 9.18(2)*: This alternative specifies the options of disconnecting, blanking, blinding, or a double block and bleed system.
2. *Isolation per engineering certification (section 9.18(3)(b))*: This alternative enables an employer to have a professional engineer certify a means of isolation as making the confined space safe for a worker to carry out the intended work in the confined space. Refer to OHS Guideline G9.18(3)(b) for more details
3. *De-energizing and locking out the pressure source*: This control option applies if there is no head pressure in the adjacent piping (i.e., from neither gravity nor pumps). With this option, it is acceptable to de-energize and lock out each pressure source and depressurize the adjacent piping.

   For this option to apply, the layout of the adjacent piping has to be such that if all of the valves are opened with pumps locked out, fluid would not flow into the confined space. In such cases, locking out the pumps and depressurizing the line provides sufficient control.

Prohibition on the use of valves
The use of one or more valves as a means of isolation is not permitted except in certain specified cases for substances that are not volatile liquids, gases, or vapours; or are harmful only because of pressure, temperature, or quantity. If a double block and bleed system is used, it must meet the requirements of section 9.21.

The *Regulation* permits the use of valves as a means of isolation in the following two circumstances:

- Where a double block and bleed system is permitted under sections 9.18(2) and 9.18(3)(a)
- Systems of isolation as permitted under section 9.18(3)(b). (refer to OHS Guideline G9.18(3)(b))

Application of sections 9.18(4) and (5) - Gravity flow sewer systems
This provision could apply to an industrial or sewage system confined space facility that has a sink or other plumbed device that connects to a sewer system.

A p-trap may be used as a means of isolation if all the following conditions are met:

1. The confined space is being isolated from a municipal or domestic sanitary or storm sewer system.

2. The sewer system is gravity flow only at the point of isolation. (The p-trap option does not apply to locations in sewer systems that are pressurized by a pump.)
3. The atmosphere is tested immediately prior to entry and the test results show that the space contains clean respirable air. Clean respirable air is defined in *Regulation* section 9.1.
4. The operational integrity of the p-trap is confirmed immediately on the entry of the worker. This may be as simple as pouring water into the trap in some cases.
5. Clean respirable air is maintained (as shown by continuous monitoring) while the worker is inside the space.

G9.18.1 Exemption to restriction on use of valves for isolation

Retired on February 1, 2011

Some of the information in this guideline is not applicable after the *OHS Regulation* amendments of February 1, 2011 and has been retired. Other information from the guideline has been moved to new guideline G9.18(3)(b).

G9.18(3)(b) Certification of isolation by a professional engineer

Issued February 1, 2011

Regulatory excerpt
Section 9.18(3)(b) of the *OHS Regulation* ("*Regulation*") states:

> (3) Before a worker enters a confined space where adjacent piping contains a substance that is harmful only because of the temperature, pressure or quantity of the substance, the harmful substance must be controlled…
>
> (b) by isolating the adjacent piping in a manner that a professional engineer has certified will make the confined space safe for a worker to carry out the intended work, or…

Purpose of guideline
This guideline provides general information on the application of section 9.18(3)(b) and specific information on two circumstances where an employer might choose for a professional engineer to certify that the adjacent piping is isolated in a manner that makes it safe for a worker to carry out the intended work inside the confined space.

Application of section 9.18(3)(b)
This section applies to substances that are harmful only because of the temperature, pressure, or quantity of the substance (and are not classified as harmful by virtue of their toxic, irritant, corrosive, or other harmful properties). Section 9.18(3)(b) does not apply if the substance can create a hazard while at the same time providing poor warning of the hazard. The lack of warning that a potential hazard exists is an additional hazard. For instance, this section does not apply to nitrogen or inert gases.

Mainly this section will apply to water or steam. WorkSafeBC recognizes that, for these substances, there are circumstances where it is impracticable to isolate the substance by disconnecting, blinding, blanking, or using double block and bleed technology, and this section provides for an alternative manner of isolation.

An example of a situation where this means of isolation might apply is where an employer uses an inflatable bladder in a water line to stop the flow of water into the confined space. Another example is where, in a waterworks system, an engineered shutoff float in a chamber is used as a means to prevent water from rising to a height where it would be discharged via a pipe to a confined space. If the rate of flow could endanger workers if the float failed, a professional engineer must certify that the adjacent piping is isolated in a manner that will make the space safe.

Engineering certifications specifically need to address worker safety and should typically include consideration of the amount of leakage, age, and maintenance history of the piping components and any other means in place to make the confined space safe for a worker to carry out the intended work. Certifications are expected to be site specific and time limited, and the engineer will need to make the determination of the applicable time period as part of the certification process.

A professional engineer may not always have sufficient information about a valve that is to be used to control potential flow into the confined space and may not be able to examine it. In this case, the engineer could consider information such as the age, history, and maintenance records for the adjacent piping system, leakage rates, and measures such as leak control or line pressure reductions that can be accomplished etc.

Certifications by engineers under section 9.18(3)(b) will need to be available for review by a WorkSafeBC prevention officer where necessary to assess compliance with the requirements. If a prevention officer has concerns about an engineering certification under this section, the prevention officer should discuss the concerns with the WorkSafeBC Engineering Department (refer to OHS Guideline G1.1).

Two common circumstances where section 9.18(3)(b) applies are public water supply systems (e.g., valve and meter chambers where work may affect the integrity of piping systems passing through the confined space) and dam water passageways.

Public water supply systems provide water for domestic uses such as human consumption, food preparation, and cleaning purposes. They also provide water distribution networks for fire suppression, which are typically an integral part of public water supply systems.

Note: In some cases, public water will be used downstream for industrial uses, for example in a process industry or a manufacturing

facility. Section 9.18(3)(b) does not apply to such industrial systems if chemical additives could be present or the spaces present hazards other than just temperature (e.g., hot or cold), pressure (e.g., force of the flow), or quantity (immersion hazard).

The system of isolation may be one or more closed valves, use of inflatable bladders, or some other means of isolation. The professional engineer must certify that the adjacent piping is isolated in a manner that makes it safe for a worker to carry out the intended work. The engineer will need knowledge of the valves or other closure devices as well as the nature of the substance in the adjacent piping.

Dam water passageways: At a dam and associated hydroelectric station there may be a number of confined spaces, for example, fuel storage tanks, which are not part of the dam water flow system, and for which this section would not apply. The application of section 9.18(3)(b) is restricted to dam water passageways at the site.

G9.20(1) Blanks and blinds

Issued May 30, 2015

Regulatory excerpt
Section 9.20(1) of the *OHS Regulation* ("*Regulation*") states:

> Unless certified by a professional engineer to provide adequate safety for the particular conditions of anticipated pressure, temperature and service, a blank or blind must be manufactured in accordance with the specifications of one of the following standards:
>
> (a) *ANSI Standard API 590-1985, Steel Line Blanks;*
>
> (b) *ANSI Standard ASME/ANSI B16.5-1988, Pipe Flanges and Flanged Fittings;*
>
> (c) *ANSI Standard ASME B31.1-1992, Power Piping;*
>
> (d) *ANSI Standard ASME B31.3-1993, Chemical Plant and Petroleum Refinery Piping*.

Purpose of guideline
This guideline provides information on an alternative standard for the standard referenced in section 9.20(1)(a) of the *Regulation* regarding blanks and blinds.

Authority to accept alternative standards
Section 4.4(2)(a) of the *Regulation* addresses the capability of WorkSafeBC to accept alternative standards. This provision states:

> When this *Regulation* requires a person to comply with
>
> (a) a publication, code or standard of the Board or another agency, the person may, as an alternative, comply with another publication, code or standard acceptable to the Board.

WorkSafeBC has determined that the following standard is an acceptable alternative to the standard referenced in section 9.20(1)(a) of the *Regulation*.

Acceptable alternative standard
WorkSafeBC accepts *ANSI Standard ANSI/ASME B16.48-2010 Line Blanks* as an alternative standard to *ANSI Standard API 590-1985, Steel Line Blanks*.

G9.22 Alternative measures of control or isolation of adjacent piping â€“ Making submissions

Issued October 30, 2018; Editorial Revision April 9, 2019

Regulatory excerpt
Section 9.22 of the OHS Regulation ("*Regulation*") states:

> (1) Section 9.18 does not apply if
>
> (a) a measure specified in section 9.18 to control or isolate harmful substances contained in adjacent piping from a confined space is not practicable, and
>
> (b) the employer implements alternative measures of control or isolation that are acceptable to the Board.
>
> (2) All workers affected by measures implemented under subsection (1) must be informed of the measures taken and instructed in any applicable work procedures.

Purpose of guideline
This guideline outlines who an employer should contact at WorkSafeBC to determine if alternative measures under section 9.22 of the *Regulation* are acceptable, and the types of information to include in the submission. It also provides information on how WorkSafeBC will issue its decisions.

Contacting WorkSafeBC for acceptance of alternative measures
If an employer develops a set of alternative measures for a confined space within or connected to a municipal sewage system, the employer should make the submission to regional offices of WorkSafeBC to have the application reviewed and accepted by the local WorkSafeBC prevention officer.

If an employer wants to implement alternative measures for other land-based sewage systems, such as industrial systems which are not connected to municipal sewers, or for all other types of confined spaces, submissions should be made to the Prevention Practices and Quality department of the Worker and Employer Services division of WorkSafeBC in Richmond at: varohs@worksafebc.com.

Work may not be conducted until the alternative measures have been reviewed and accepted by either the local prevention officer or the Prevention Practices and Quality department. The applicant may be an employer who owns or operates the confined space, or a contractor or a consultant working on behalf of the owner.

What to include in the submission
A submission may cover a single confined space or a group of confined spaces that share similar characteristics. The focus of any alternative measures should be on the liquids, gases and vapours, and other flowable materials that would be controlled by the isolation measures listed under section 9.18 of the *Regulation*.

In some cases it may be impracticable to isolate the adjacent piping but partial or complete isolation may be possible with temporary dams, inflatable bladders, or other means such as rerouting of fluid flow. However, in other cases, alternative measures to ensure worker safety will involve a set of occupational hygiene and safety precautions other than, or in addition to, isolation. In all cases, the selection of controls must align with the risk associated with the substance being controlled and potential for the control system to fail.

Main elements of the submission
The submission should address matters that include the following elements:

1. Scope of application - A description of the space and work activities, or the group of confined spaces with similar characteristics for which the submission is made. Photographs/diagrams are useful in describing the space.
2. Why isolation using the measures specified in section 9.18 of the *Regulation* are not practicable.
3. Contact information for the person who administers the confined space program, and for the qualified person(s) who conducted the hazard assessment and prepared the alternative measures.
4. A description of the hazards to be addressed by the alternative measures, the hazard classification of the undisturbed space, and the hazard classification following the implementation of control measures.
5. The alternative measures that will be used to address the hazards, and how workers will receive protection from the hazards through use of the measures.
6. How workers who are required to use the proposed measures will be informed of the measures taken and instructed in the applicable work procedures, as required by section 9.22(2).
7. How use of the alternative measures will be supervised and who will be responsible for supervision on the site.
8. The time period for which the alternative measures will be needed.

The submission should also include information from the joint OHS committee or worker health and safety representative, as applicable, indicating their comments on the proposal, or other information that indicates the affected party has been consulted on the alternative measures. (Section 9.11(1)(b) of the *Regulation* requires consultation with these parties on confined space hazard assessments and written procedures.)

Information needed for Element #4 - hazards to be addressed
Hazards associated with the isolation of the confined space typically involve those arising from liquids, gases and vapours, and other materials such as slurries, dusts, and powders that could flow into the space. The submission should address matters such as the following, where applicable:

- Potential for material to flow into the space
- Characteristics of the material including pressure, temperature, quantity, toxicity, and corrosive properties
- Other hazards associated with the flow of material into the space, such as engulfment, slips and falls, electric shock, reduced visibility, and moving machinery or equipment
- Review of historical air monitoring for site (if available and applicable)
- Any potential for work being done in the space that could introduce or contribute to a hazardous condition

Information needed for Element #5 - Alternative measures to be used
The measures chosen should be based on careful consideration of the hazards, and provide the most effective means of dealing with them. The submission should cover matters such as the following, where applicable:

- Means of controlling or eliminating the hazard, and related procedures (e.g., engineers' certification and instructions regarding suitability and operation of valves used for single valve isolation, where applicable)
- Monitoring and measurement of flow rates of materials and/or levels in the confined space
- Installation and monitoring of bladder pressure devices
- The method of communication between a person or system for monitoring material flow and entry workers
- Emergency and rescue procedures in the event of any isolation system failure
- Manufacturer's instructions and specifications
- Process for verifying control measures

- Roles and responsibilities specific to the alternative measures

Issuing a decision
Decision made by a prevention officer on behalf of WorkSafeBC: As needed, the prevention officer may contact the Engineering department, senior occupational hygienists, or the Prevention Practices and Quality department for advice. The prevention officer may also request other information and supporting documents related to the confined space (e.g., hazard assessments, entry procedures, historical data, or information from previous acceptances).

The prevention officer's decision will be recorded, including the terms of the decision and time period for which it is issued, in the text of an inspection report for the firm. The prevention officer will provide a copy to the employer, who must post a copy at the worksite as required by the *Regulation*. Once the decision is made, the prevention officer will forward the request and decision to the Prevention Practices and Quality department.

Decision made by the Prevention Practices and Quality Department: The Prevention Practices and Quality department will issue the decision to the applicant using the standard format for Acceptance Request (AR) decisions. The applicant will post a copy of the acceptance at the worksite and ensure copies are distributed to workplace parties, as required by the terms of the acceptance.

Copies will be sent to the WorkSafeBC local prevention field services manager and prevention officer responsible for the firm, and to others who contributed information to the decision-making process.

All decisions may consider whether the acceptance will apply to one firm or to multiple firms, depending on the specific circumstances. If the alternative measures are accepted, the prevention officer's decision will state that the measures set out in the application package must be followed. It may also include additional terms. The decision will also specify the time period for which the acceptance will apply, to a maximum of three years.

All decisions will focus on the issue of alternative measures for isolation of the confined space under section 9.22 of the *Regulation*. They will not, as a rule, address the issue of compliance with other provisions of the *Regulation* and must not be taken as an endorsement of the overall confined space program for the site.

Additional information related to alternative control measures in municipal sewage systems that may assist in preparing submissions.
NB: None of the information in this guideline is to be used as a substitute to preparing a site-specific hazard assessment and development of associated safe procedures by a qualified person, as required under sections 9.9 - 9.11 of the Regulation.

General comments and consideration on hazards and alternative control measures in sewage systems

1. Hazards
For any storm or sanitary sewage system, hazards that can be encountered include engulfment or immersion, exposure to toxic gases or vapours, oxygen deficiency, flammable atmospheres, slipping or tripping hazards, and electrical hazards where energized conductors or electrical equipment are exposed to damp conditions or liquid contact.

The potential for immersion will vary depending on factors including the frequency and volumes of discharges to the system, precipitation, and the relationship between the rate of possible fluid flow into the confined space to the dimensions of the space. For example, if the space is relatively small, and the diameter of inlet piping is substantial, there may be a relatively high potential for immersion. The contrary is the case where the floor area and volume of the space is large relative to possible fluid flows into it.

Water in sewage systems may be contaminated by materials such as oils from roadway runoff or industrial discharges, and in some cases materials such as ferrous chloride or other substances may be added for purposes of corrosion or odour control.

Air contaminants of concern in sewage systems include hydrogen sulfide, carbon monoxide, carbon dioxide, methane, ammonia, and organic vapours from oils or fuels that have entered the systems from roadway runoff. Decomposition gases such as hydrogen sulfide and methane can be a particular issue where sludge and other organic matter have been allowed to accumulate, and can be off gassed, particularly when the materials are disturbed. The term "sewer gas" is often used to refer to gases in sewage systems. It is an imprecise term, sometimes used in reference to hydrogen sulfide, but also to the complex mixture of gases that can be present.

In sanitary sewage systems, fluids may contain waterborne organisms that may cause disease (for example, hepatitis, giardiasis, and leptospirosis). Diseases affecting the gastrointestinal or respiratory systems have been reported among sewage workers.

Hazards from exposure to fluids and gases in piping may be complicated by other issues such as restricted visibility, limits to communication, and distance from exit points.

2. Alternative control measures
Various aspects of alternative control measures are discussed below, from fluid control to instruction and training.

- **Fluid control:** In some cases fluid flow can be controlled in sewage systems.
  Examples of fluid control techniques include the following:
    - Inserting inflatable rubber bladders into pipes
    - Cutting into pipes to install removable sealing devices

- Closing valves or gates
- Installing mechanical blocking devices that consist of double seals designed so that the space between the seals may be monitored or pressurized to greater than the pressure of the hazardous fluid
- Directing fluid flows through piping or channels adjacent to the space in question
- Freezing of the pipe contents to form a plug in the pipe
- Performing work when events such as heavy rainfall or tides ensure that the fluid level does not present a hazard

The choice of method for fluid control will depend on what is feasible in the situation. In all cases the basic principle is that the most effective of the feasible methods should be chosen. Wherever manufactured devices are used, manufacturer's instructions and safe work practices must be followed. For example, the safe use of bladders will typically include measures such as cleaning the piping into which the bladder is placed, inflating the bladder only to permitted pressures, and securing the bladder so that it is not displaced in the pipe by a buildup of pressure behind it.

If devices that control the fluid flow are capable of being locked out then the requirements of Part 10 (De-energization and lockout) of the *Regulation* apply. The analysis of valves as a control measure should assume that all valves leak. However, there is no expectation that a properly installed and maintained valve will fail catastrophically if no work is being performed on it.

- **Leakage of liquid and pumping:** It is recognized that systems will often permit some leakage, and in that event, a means of pumping out the fluid may be necessary. A means of monitoring leakage, coupled with procedures for evacuation in the event leakage rates or fluid levels exceed safety criteria, is often a necessary feature of the safety system. Liquid level alarms or visual checks may be required to monitor liquid levels. It may be possible to set up a leakage check system from a central control location using camera monitors or other means.

- **Air monitoring and ventilation:** The historical record of atmospheric testing inside of the confined space needs to be considered along with the recent physical condition of the space. For instance, historical atmospheric testing during conditions of normal fluid flows may have not indicated atmospheric hazards. However, a space that has been left stagnant may have allowed material to decompose and create atmospheric hazards. The use of personal air monitors or other means of continuous monitoring will assist with worker safety where there is the potential for air contaminants to be present.

  Ventilation must be adequate, and be provided in conformity with the requirements in Part 9 (Confined spaces) of the *Regulation*. When used as part of an alternative measure, the ventilation may have to be increased to displace potentially contaminated air, as well as supply sufficient clean respirable air to the workers in the space.

- **Communications:** A means of communication with workers in the confined space will need to be provided and periodically verified as being effective.

- **Personal protective equipment:** Workers must be supplied with and use appropriate personal protective equipment as required by the *Regulation* to protect against hazards that cannot be eliminated. This will include protective clothing and gloves, as well as respiratory protection.

- **Slipping, tripping, and electrical hazards:** Sewage systems are typically damp or wet environments, and appropriate measures must be taken regarding slipping, tripping, and electrical hazards. If fluid entering the confined space conceals trip and fall hazards such as floor holes or openings, these hazards need to be addressed, as well as any hazards involving the potential for liquid contact with energized conductors and equipment.

- **Evacuation planning:** Where there is a danger from the uncontrolled entry of liquid into the confined space, the time required to evacuate workers from the confined space needs to be shorter than the minimum possible time it would take fluid entering the confined space to create a condition that would impede exit from it. In general, the time is calculated using the maximum possible flow from the pipes that could be created by the failure of any single system element, and the relationship of that flow to the floor area of the space. The time required for evacuation should make allowance for possible problems during evacuation. The number, location, and types of exits are relevant in determining the evacuation time. Means of access and egress should be made as convenient as possible. It is recognized that in some cases catastrophic failure of the control system could lead to immediate danger to workers from fluid flow. For that reason, isolation measures need to provide a high level of assurance that such circumstances will not occur. Evacuation measures need to be designed to minimize the time needed to exit, and rescue plans must be in place.

  Evacuation times in the event of the development of harmful atmospheres may be more difficult to predict, and steps must be taken to ensure that personal protective equipment and rescue measures are up to the task. Depending on the potential exposure, workers in the confined space may be required to be permanently attached to a lifeline, or detach from the lifeline where entanglement of the line is a potential hazard.

- **Instruction and training:** All workers affected by alternative measures must be informed of the measures taken and instructed in any applicable work procedures, including emergency measures. Workers also need to be informed of any residual hazards not fully controlled by other measures. Some considerations are provided in the remainder of this guideline for three typical parts of sewage systems: piping, pumping stations, and sewage treatment plants.

Specific comments on various consideration for piping, pumping stations, and treatment plants

1. Storm and sanitary sewage piping
When a worker enters a sewage pipe, the pipe itself is the confined space, not "adjacent piping" from which the space must be isolated as required by section 9.18 of the *Regulation*. However, the feeder pipes that discharge into the pipe that is entered can be considered to be adjacent piping.

When dealing with piping systems, there may be limits on the practicability of some standard occupational hygiene control measures. For example, ventilation as a means of assuring a safe atmosphere may not be practicable if the work must be done over a length of the piping system a substantial distance away from access points. However, wherever ventilation is feasible, it should be used, and it must always be provided where required by the *Regulation*. If ventilation cannot assure a safe atmosphere, reliance may need to be placed on air monitoring and respiratory protection, including air supplied respirators where the circumstances warrant.

Hazards in piping will vary somewhat depending on whether the piping is a storm or sanitary sewer, or both. Often the piping will carry both storm and sanitary sewage in a combined system.

Sanitary sewers will have hazards associated with organic matter, including biological hazards, as well as air contaminants such as hydrogen sulfide or methane from the decomposition of organic matter. Such gases may be particularly an issue where sludge and other materials have been allowed to accumulate, and are subsequently disturbed. Where sewage flows at a rate of 2-3 feet per second (2-3 km/h) sedimentation and sludge build up is less likely. However, in such cases blockages can still occur where objects impede flow, or the diameter of the piping is an issue.

Flow volumes and rates will vary according to sewage discharge patterns in the catchment area and precipitation. Predicting patterns of flow will assist with worker safety.

Storm sewers will typically include hazards associated with water flows, which will vary with precipitation and drainage patterns in the area. Drainage from streets and parking areas is likely to be contaminated with oil and other hydrocarbon residues from vehicles. Also, where access locations to the sewers are in proximity to idling vehicles, for example at intersections and parking areas, there is the potential for exposure to exhaust gases including carbon monoxide.

Both sanitary and storm sewers may be contaminated with industrial or household chemicals, and with potentially harmful objects such as needles.

2. Sewage pumping stations
For pumping stations that are confined spaces the adjacent piping will typically be the sewer lines that feed into a reservoir or sump and the pipes used to discharge the sewage. There may also be drains that are arranged so that the contents of the drain could enter a sump and merge with the general sewage flow. Gases must be considered as well as liquids. Various means of controlling fluid flow may be possible. Given the proximity to a point of access, and the limited space involved, it should always be possible to provide effective ventilation into a pumping station.

The timing of events must also be considered in the hazard analysis. For instance, the level and composition of off-gassing may depend on how long it has been since a channel or pipe has been emptied of residue. It may also be affected by the extent of liquid agitation and the surface area in contact with the atmosphere in partially-filled pipes.

Knowledge of historical flow patterns and contamination problems could be of assistance in performing the required hazard analysis. Anticipated weather patterns may also affect the scheduling of the work inside of the confined space in order to minimize worker exposure to hazards of fluid flow.

3. Sewage treatment plants
Many of the hazards from fluid flow in sewage treatment plants are similar to those encountered elsewhere in sewage systems. Treatment plants offer certain advantages in terms of hazard control given that work activities occur at fixed sites and often above ground. The design of the system at the site may help ensure that the need for alternative measures is minimized.

Some of the hazard issues at the plants include chemicals used to treat sewage, potential for exposure to tidal water for facilities on the coast, and hazards arising from the treatment system. For example, the potential for hydrogen sulfide and methane to develop from the decomposition of organic material may be a particular issue in desludging operations in secondary sedimentation tanks, on the tops of sewage digesters, and in any tanker loading or unloading operations.

Sewage treatment plants may have channels that are connected by orifices or weirs. Such connections are not necessarily "adjacent piping." However, any hazards created by these adjacent channels need to be addressed. The hazards to workers from entry into channels will vary somewhat depending whether or not the channels are open or closed.

A means of fluid control that is possible in some circumstances is to channel fluid flow around the space in which worker entry is required. Alternative fluid control measures that can be used include sealing devices that are installed through holes drilled in the side of pipes and inflatable bladders. In such cases, ensure that the manufacturer's instructions and other necessary safe procedures are followed.

Where discharge occurs into tidal water it may be possible to plan the timing of work so that ocean tides do not create a liquid hazard from the

outlet side.

G9.22-1 Alternate measures - Making submissions

Issued August 1, 1999; Editorial Revision October 2004; Editorial Revision February 7, 2006; Editorial Revision June 6, 2006; Editorial Revision June 22, 2007; Revised April 9, 2008; Editorial Revision to include February 1, 2011 regulatory amendments; Retired October 30, 2018

This guideline is no longer required due to the creation of new guideline *G9.22 Alternative measures of control or isolation of adjacent piping - Making submissions*.

G9.22-2 Alternate measures for confined spaces - Municipal sewage systems

Issued April 9, 2008; Editorial Revision June 10, 2010; Editorial Revision to include February 1, 2011 regulatory amendment; Revised September 21, 2011; Retired October 30, 2018

This guideline is no longer required due to the creation of new guideline *G9.22 Alternative measures of control or isolation of adjacent piping - Making submissions*.

G9.39 Notification

Issued August 1, 1999

Section 9.39 of the *OHS Regulation* requires the notification of rescue persons before workers enter a confined space. Section 9.39(3) states "If more than one confined space is to be entered at the same time, notification of rescue personnel to be on alert status at the commencement of work is adequate."

In determining the rescue services to be provided, the employer should assess the risks from workers entering into more than one space entry at the same time. If the rescue services are called upon for one space, and there is insufficient rescue capacity to deal with emergencies in other confined spaces at the same time, the employer must terminate the entry or use of workers in other spaces during the rescue operations.

Examples of industries that may involve several confined space entries at the same time are petroleum refineries, pulp mills, tank and rail car cleaning operations and bulk storage facilities.

G9.41 Rescue procedures

Issued August 1, 1999

Section 9.41(3) of the *OHS Regulation* states "A rescue worker must not enter a confined space unless there is at least one additional worker located outside to render assistance."

The stand-by person required by sections 9.34 to 9.36 may serve as a rescue worker, or as the backup worker required by section 9.41(3), provided the person is properly trained and adequately equipped. Where this occurs, the confined space rescue situation will involve a minimum of 3 people: the worker in the confined space needing rescue, the standby/rescue worker, and a third worker to meet the requirements of section 9.41(3). Four or more persons may be required if the standby person does not serve as one of the rescue workers required by section 9.41(3).

Paragraph 9.36(e) requires that in a high hazard atmosphere confined space the stand-by worker must be "equipped and capable of immediately effecting rescue using lifting equipment if required, or otherwise performing the duties of rescue persons". Wherever possible, rescue procedures and plans should rely on rescue of workers in a manner that does not require additional personnel to be placed at risk. For example, rescue from outside the space using lifting devices, and the stand-by worker as the rescue worker, puts no rescue workers at risk. In addition, rescue without entry would not necessarily require an additional rescue worker to render assistance under section 9.41(3).

The means of supplying rescue services are part of the hazard assessment under section 9.9 and covered by the written procedures under sections 9.5 and 9.10.

G9.27 Cleaning, purging and venting

Issued August 1, 1999

Section 9.27(1) of the *OHS Regulation* states "When practicable, the employer must ensure that a confined space to be entered contains clean respirable air." Section 9.27(2) states "If a confined space is known, or shown by pre-entry testing to contain other than clean respirable air, the hazard must be controlled by cleaning, purging or venting the space and the atmosphere must be retested before a worker enters the space."

More than one cleaning, purging or venting may be required to achieve a confined space with clean respirable air. It depends on what is practicable and reasonable in the circumstances. If continued cleaning, purging or venting will further the objective of having a clean respirable atmosphere, these processes should be repeated. If continuing these processes will not effectively improve the residual atmospheric quality, then the employer may proceed with entry in accordance with section 9.28 of the *OHS Regulation*.

Issued August 1, 1999; Revised May 9, 2006; Editorial Revision to include February 1, 2011 regulatory amendment; Editorial Revision consequential to August 4, 2015 Regulatory Amendment

Regulatory excerpt
Section 9.29 (Inerting) of the *OHS Regulation* ("*Regulation*") states:

> (1) The employer must notify the Board in writing, and submit a copy of the proposed work procedures, at least 7 days before a worker enters a confined space which has been inerted.
>
> (2) The employer must follow any additional precautions that are prescribed by the Board after review of the notification.
>
> (3) If a confined space has been inerted
>
> (a) all entry precautions for high hazard atmospheres must be followed, except the requirement for continuous ventilation,
>
> (b) every worker entering the confined space must be equipped with a supplied-air respirator meeting the requirements of Part 8 (Personal Protective Clothing and Equipment),
>
> (c) all ignition sources must be controlled, and
>
> (d) the atmosphere inside the confined space must remain inerted while workers are inside.
>
> (4) Subsection (1) does not apply to entry for the purpose of performing emergency rescue duties.

Purpose of guideline
This guideline provides information for employers on how to notify WorkSafeBC prior to inerting a confined space, and the types of information to include in the submission. It also provides information to WorkSafeBC prevention officers to assist with reviewing applications.

How to notify WorkSafeBC
Section 9.29(1) of the *Regulation* requires an employer to notify WorkSafeBC in writing of an intent to enter an inerted confined space, and to submit a copy of proposed work procedures at least seven days before entry. As noted in section 9.29(4), this obligation does not apply if the entry is in an emergency situation for the purpose of performing rescue duties.

Information can be sent by post, fax, or by e-mail. However, regardless of the means of communication, the written communication must be received by WorkSafeBC at least seven calendar days before planned entry. It is not sufficient to call WorkSafeBC seven days or more before entry and then submit the written request in less than the required time.

The request should be sent to the nearest WorkSafeBC office, to the attention of the Prevention Regional Manager, or to the Occupational Hygiene Officer responsible for the worksite where the entry will occur. Notifications often arise from refining and fuel manufacturing operations in the oil and gas sector. Typically such operations are found in Northeast or Northwest B.C., or in the Lower Mainland. For these locales, inspectional programs are handled, respectively, from the Prince George, Terrace and the Burnaby/Coquitlam offices of WorkSafeBC.

Information on how to contact offices of WorkSafeBC is found on the web site at www. worksafebc.com. Click on the "Contact Us" button on the home page. Or alternatively, the information is available by calling the Prevention Information Line at 604-276-3100, or toll free in B.C. at 1-888-621-7233.

Preparing the submission
While section 9.29 of the *Regulation* deals with requirements specific to inerting, other requirements of Part 9 (Confined spaces) also apply. Of central concern is that the necessary hazard assessment has been done and associated work procedures developed, as required by sections 9.9 to 9.11. Under these provisions the hazard assessment and work procedures must be prepared by a qualified person(s) and, as applicable, the joint occupational health and safety (OHS) committee or worker OHS representative must be consulted.

The work associated with inerting is often highly specialized, and may involve the services of a contractor. Where a prime contractor or owner arranges for a contractor to conduct the work, then the contractor's joint OHS committee or worker OHS representative will need to be consulted. Where workers of the prime contractor will be engaged in any of the work associated with the confined space, for example, in preparation of the space, work in it or in an emergency rescue, then consultation with the prime contractor/owner's joint OHS committee or worker OHS representative will also be needed.

To permit proper assessment by WorkSafeBC, the submission will need to include the following:

- The worksite location and specific identity of the confined space, and the date of intended entry.
- The identity of the qualified person(s) who prepared the hazard assessment and work procedures, the confined space entry program administrator, the person supervising the job and, where applicable on a multi-employer site, the person coordinating work activities.
- Information on consultation with the joint OHS committee or worker OHS representative, as applicable, on the hazard assessment for the confined space and associated work procedures.
- The written hazard assessment of the confined space to be inerted. The assessment, which is key to developing safe work procedures, will address the factors outlined in section 9.9 of the *Regulation*, including any factors related to inerting, such as the presence of any

pyrophoric (spontaneously flammable), oxidizing, flammable or other reactive materials, and any sources of ignition.
- Written work procedures for entry and work in the confined space, which specify the means to eliminate or minimize all hazards likely to be present. Procedures also will need to address the safe removal of any waste material and the installation of any replacement material, as applicable. The procedures must also be in compliance with the four conditions outlined in section 9.29(3) related to
    - precautions for high hazard atmospheres
    - a supplied-air respirator
    - control of ignition sources
    - the necessity that the inert atmosphere will be in place for the entire time that workers are inside the confined space
- Safety data sheet(s) or hazardous waste profile sheet(s) for any waste material to be removed from the space.

Reviewing the submission
The assigned prevention officer will be responsible for reviewing the application and making a determination of any concerns or issues with the proposed procedures to be addressed by the applicant. Precautionary information should be entered into inspection text on an Inspection Report and communicated to the employer prior to entry. Where work is being done by a contractor, both the prime contractor and contracted employer will need to be advised.

To assist with the review, the prevention officer may wish to examine previous decisions related to inerting confined spaces, or consult with persons who have been involved with such decisions. This may include the Occupational Hygiene Variance Coordinator or Senior Occupational Hygienist, the Senior Prevention Adviser or, as applicable, other prevention officers and the Regional Manager. Consultation may be particularly appropriate in circumstances such as reviewing procedures for types of spaces not previously considered by WorkSafeBC.

If the applicant is a visiting contractor, it may be necessary for the contractor to do a final hazard assessment after arrival on site. It is expected in such cases that the assessment process will ensure that all significant hazards are addressed in the submission to WorkSafeBC, and that a final hazard assessment would only be for the purposes of fine tuning work procedures on minor issues. The hazard assessment and work procedures submitted to WorkSafeBC should be as specific as possible to the conditions on the site where the work will be done.

For example, if the contractor had previously done inerting work in a confined space, then the assessment and procedures should, at minimum, be based on the specific circumstances of that previous work, coupled with any adjustments arising from additional information received from the prime contractor or owner prior to the present job. Any final minor adjustments to the hazard assessment and procedures will be done by a qualified person in consultation with workplace parties, as required by section 9.11.

The prevention officer may, in these or other circumstances, attend the site prior to the confined space being inerted.

Copy to Prevention Practices and Quality
Once the prevention officer's review is complete, materials will be entered into a firm file following normal procedures. A copy of the submission, any additional relevant materials, and the prevention officer's determination regarding the need for further precautions will also be forwarded to the Prevention Practices and Quality Department of WorkSafeBC.

G9.24 Verifying all precautions

Issued August 1, 1999

Section 9.24 of the *OHS Regulation* states "Before a worker enters a confined space, pre-entry testing and inspection must be conducted to verify that the required precautions have been effective at controlling the identified hazards and that it is safe for a worker to enter."

Section 9.25 of the *OHS Regulation* requires the atmosphere in a confined space to be tested in a number of circumstances before a worker enters the confined space. The requirements of section 9.24 are not limited to atmospheric testing. Other hazards, such as entrapment, radiation, heat stress, noise and cold stress may also be present. These require assessment regarding the degree of risk to workers.

In addition, it is necessary to inspect before entry to ensure that all required controls are in place. These are similar to requirements for supervisor responsibility stated in section 9.7(2).

G9.25 Testing the atmosphere

Issued August 1, 1999; Revised November 17, 2003

Additional testing

Section 9.25(4) of the *OHS Regulation* states "While a worker is inside a confined space with a moderate or high hazard atmosphere, additional testing must be conducted as necessary to ensure the worker's continuing safety."

The intervals at which additional testing should occur depends on the outcome of the hazard assessment, the operations being performed in the space and the risk of the atmosphere changing substantially. In addition, the selection of appropriate instrumentation for testing of the space, together with the requirement of section 9.25(5) for continuous monitoring, may determine the frequency of testing that is practicable.

Continuous monitoring

Section 9.25(5) states "Whenever practicable, continuous monitoring of the atmosphere must be done."

"Practicable" is defined in section 1.1 of the *OHS Regulation* as meaning "that which is reasonably capable of being done". In determining what is "practicable", the relevant factors include:

- the availability in the marketplace of continuous monitoring devices,
- the reliability of continuous monitoring devices to detect contaminants within acceptable ranges to provide worker protection (this means in the range of the exposure limit or lower), and
- the potential for cross contamination or poisoning of the sensors for the instrumentation selected.

Low hazard atmospheres

Section 9.25(7) permits entry into low hazard atmospheres without pre-entry atmospheric testing if the conditions listed in paragraphs (a) to (d) are met. Condition (c) is that "prior representative sampling has demonstrated that the atmosphere within the space or group of similar spaces meets the low hazard atmosphere definition".

"Representative sampling" is acceptable if the sampling data is

- statistically significant,
- provides for the reliable determination of worker exposure, and
- obtained in accordance with the confidence limits stated in OHS Guideline G5.48-9.

G9.26 Procedures and equipment

Issued August 1, 1999

Section 9.26(4) of the *OHS Regulation* states "Test results, other than continuous monitoring results, must be posted without delay at all points of entry to the confined space."

Continuous monitoring provides continuous feedback to the personnel entering and working in the confined space. In effect, this provides better feedback than the posting of test results at all entrances to the confined space. However, the section does not exempt the employer from recording continuous monitoring test results at appropriate intervals as required by section 9.26(3). Many instruments used for this purpose are equipped with a data logging capability that makes it easy to record test results and to interpret the data. Otherwise, readings can be manually recorded at appropriate time intervals.

Keeping records of continuous monitoring will be particularly important for employers wanting to eliminate pre-entry atmospheric testing for a low hazard atmosphere confined space, as it may be a source for the data required by paragraph 9.25(7)(c).

G9.26(2) Qualified person for calibration of confined space atmospheric testing equipment

Issued consequential to February 1, 2012 Regulatory Amendment

Regulatory excerpt
Section 9.26(2) of the *OHS Regulation* ("*Regulation*") states:

> Each confined space test must be carried out by a qualified person who has training and experience to calibrate, operate and monitor testing equipment and interpret readings from the testing equipment.

Section 4.3(2) states:

> Unless otherwise specified by this Regulation, the installation, inspection, testing, repair and maintenance of a tool, machine or piece of equipment must be carried out
>
> (a) In accordance with the manufacturer's instructions and any standard the tool, machine or piece of equipment is required to meet, or
>
> (b) as specified by a professional engineer.

Purpose of guideline
The purpose of this guideline is to provide guidance on the qualifications necessary to perform calibration of confined space atmospheric testing equipment.

Calibration in accordance with manufacturer's instructions
Under section 4.3(2) of the *Regulation*, employers must ensure that the calibration of confined space testing equipment is done in accordance with the manufacturer's instructions or the instructions of a professional engineer.

Qualifications for confined space tester performing calibration
When atmospheric testing is performed in a confined space as required under section 9.25, section 9.26(2) specifies that it be performed by a qualified person who has training and experience to calibrate the equipment. Calibration of testing equipment is a rigorous process and may require laboratory equipment or specialized procedures available only to the manufacturer or manufacturer's representative. The *Regulation* does not

require that the qualified person identified in section 9.26(2) perform laboratory or factory calibration of the equipment. However, the qualified person (tester) needs to understand the calibration process in order to understand instrument setup and performance.

The manufacturer's instructions will usually also specify more frequent field calibrations and calibration checks (bump tests) than a periodic laboratory or factory calibration. In this case, the qualified person must be trained to perform this field calibration or calibration check.

G9.14 Expiration of an entry permit

Issued August 1, 1999

Paragraph 9.14(d) of the *OHS Regulation* states that an entry permit must identify "the time of expiration of the permit".

An entry permit will cover a specific task or project, which may occur over a number of shifts. The time of expiration of the permit is based on the estimated time to complete the project's work activities and will be identified on the permit. An entry permit should be treated as expired sooner than the stated time of expiration if one of the following occurs:

- the confined space is placed back in service,
- continuity in responsible supervision for the confined space is broken, or
- the task or project is interrupted for a significant time because of an emergency that affects the confined space, such as an accident, rescue requirement, 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.

G9.47 Emergency escape respirator

Issued August 1, 1999

Section 9.47 states "Workers entering a confined space which contains a high hazard atmosphere must carry on their person or have within arm's reach an emergency escape respirator sufficient to permit them to leave the confined space without assistance."

The selection and use of appropriate escape respirators for high hazard atmosphere confined spaces must be in accordance to the requirements of part 8 of the *OHS Regulation*, particularly section 8.36.

G9.49 Removal of oxy-fuel torches and hoses from confined spaces

Issued May 24, 2002

Section 9.49 of the *Occupational Health Safety Regulation* states:

> When practicable, torches and hoses used for welding, brazing or cutting must be removed from a confined space when not in use and when the confined space is vacated.

A "Note" is included under section 9.49. It states:

> It may be impracticable to remove hoses for some short duration breaks of 60 minutes or less, particularly where the confined space is large or where the removal of hoses may create some risks to workers, for example, when hoses are removed from scaffolding. If removal is impracticable, alternate measures must be adopted under sections 9.4 and 9.5. The preferred method in most cases is to disconnect at source with safe venting procedures together with procedures to ensure no inadvertent reconnection while workers are on the break or, if this is not practicable, closing and putting a tag on connections located outside the confined space. Other applicable requirements in Part 9 must also be followed including those on ventilation, standby persons and retesting prior to re-entry. For further information, see the OHS Guideline on section 9.49 on the Board's Internet site.

The intent of section 9.49 is to minimize the possibility of oxygen and/or fuel gas accumulating in the confined space due to leaks or improperly closed valves. Gas can accumulate rapidly in a confined space and present a high risk of fire or explosion when workers return to the space to resume work. An action such as lighting a torch could result in a catastrophic explosion and fire. Hence, when using an oxy-fuel process in a confined space, the priority is to remove the hose and torch from the confined space upon completion of the work or whenever the worker using the equipment leaves the confined space.

Due to the lay-out, size, and complexity of some confined spaces and the number and lengths of oxy-fuel hoses involved, removal of torches and hoses is not always practicable for short duration breaks (such as for coffee or lunch; typically a maximum of 60 minutes). Examples of confined spaces where removal may be impracticable include a pulp mill recovery boiler and a workspace inside the hull of a large ship berthed for repairs in a shipyard. For the latter, oxy-fuel hoses are typically fed from the dock (the usual location of the regulator/manifold), over the sides of the ship, along the deck, and extended down into the ship, to the workspace. Depending on the work required on a large vessel, many (5-15) oxy-fuel hoses may be required, each extending up to 45 metres (150 feet) in length.

Where it is not practicable for a worker to remove an oxy-fuel hose and torch from a confined space when taking a short break, the following protocol is acceptable, when it forms part of a confined space entry program (see section 9.5 of the *OHS Regulation*).

- Prior to leaving for a break, the torch is shut off by the worker and left in the confined space.
- The worker leaves the confined space and goes directly to the manifold or regulator.
- The worker shuts off the oxy-fuel lines supplying the worker's torch.
- The worker disconnects both lines from the manifold or regulator, in a manner that ensures bled-off fuel gas and oxygen from the hoses is released into an open, well-ventilated area with no sources of ignition in the immediate vicinity.
- Lines left disconnected should be protected from contamination, if necessary.
- Upon return from the break, the worker reconnects and charges the hoses.
- Before a worker re-enters the confined space to resume work:
    1. the confined space is tested (as required by section 9.25),
    2. the mechanical ventilation system is functioning (as required by section 9.30),
    3. the standby person is ready (as required by sections 9.34 to 9.36), and
    4. rescue provisions are in place (as required by sections 9.37 to 9.41).

Torches and hoses should be shut off and removed from the confined space when this equipment will not be used for an extended time, such as breaks beyond 60 minutes or overnight, or upon completion of the work.

Additional information can be found in parts 10 and 11 of CSA Standard W117.2-94, Safety in Welding, Cutting and Allied Processes. Refer also to OSHA Regulations (Standards -- 29 CFR) Fire Protection in Shipyard Employment -- 1915 Subpart P available on the Internet at

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10337

DEFINITIONS

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HAZARD ASSESSMENT AND WORK PROCEDURES

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IDENTIFICATION AND ENTRY PERMITS

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G9.18.1 Exemption to restriction on use of valves for isolation [Retired]
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VERIFICATION AND TESTING

G9.24 Verifying all precautions
G9.25 Testing the atmosphere
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CLEANING, PURGING, VENTING, INERTING

STAND-BY PERSONS

RESCUE

LIFELINES, HARNESSES AND LIFTING EQUIPMENT

PERSONAL PROTECTIVE EQUIPMENT AND OTHER PRECAUTIONS

G9.9-1 Hazard assessment

Issued August 1, 1999

The hazard assessment required by section 9.9 of the *OHS Regulation* must be performed by a "qualified person", as defined under section 9.11. Once the assessment has been done for a specific activity within a particular space or group of similar spaces, it may provide the basis for procedures for every occasion when workers enter those spaces. On each such occasion, the circumstances of the proposed job should be considered beforehand by the supervisor (who need not be a "qualified person" under section 9.11) to ensure that the criteria or conditions upon which the hazard assessment is based remain substantially the same. If the conditions are different in a way that might affect the outcome of the hazard assessment previously done by a qualified person, then the circumstances should be reviewed and entry procedures revised as necessary, by a "qualified person". The assessment of a "qualified person" cannot be changed without the concurrence of the same or another "qualified person".

Paragraph 9.9(2)(b) states that the hazard assessment required under section 9.9(1) must consider a list of specific circumstances as well as "other hazardous conditions". In general, the conditions referred to here represent requirements addressed in other parts of the *OHS Regulation*. These include, but are not limited to, fall protection, hearing conservation, radiation, heat stress, extreme climactic conditions such as flooding from heavy rains, and lockout of equipment and processes.

G9.9-2 Visiting employers

Issued August 1, 1999

The process of identifying confined spaces, assessing hazards and developing work procedures in a workplace is the responsibility of the employer who operates the business carried on at the workplace. However, employers commonly perform jobs at workplaces that they do not own or control. If an employer is sending a worker to another employer's or owner's operation, the following need to be considered to ensure the "visiting" employer meets their obligations under Part 9.

1. The visiting employer need not repeat the process of identifying and placing signs on confined spaces as required by sections 9.2 and 9.3 if this has already been done by an effective confined space entry program of the resident employer. The visiting employer should, however, inform its workers of the location and nature of any confined spaces that might affect their work and activities. The owner of a workplace, or the employer controlling a workplace, should provide this information. See also section 118 of the *Workers Compensation Act* and section 20.3 of the *OHS Regulation*.
2. If a visiting employer does work that requires one of their workers to enter a confined space, the visiting employer must have its own confined space entry program under section 9.5. The program may be generic in nature covering the general types of confined spaces its workers would be expected to enter in the course of their visits to different sites. Such generic procedures would then be supplemented by specific procedures for the activity and confined space to be entered, which may be developed in conjunction with the resident employer or site owner. All persons with duties related to confined space entry must be trained in these specific procedures before any entry into a confined space.

3. If a visiting employer is utilizing some aspects of the resident employer or owner's confined space entry program, the visiting employer has to undertake sufficient hazard identification and risk assessment to ensure their activity will be in compliance if the host employer or owner's confined space entry program is used. For example, a contractor doing welding or painting may create hazards the owner's confined space entry program did not consider in their hazard identification and risk assessment.

G9.11 Confined spaces - Qualified persons

Issued January 1, 2007

Regulatory excerpt
Section 9.11(1) of the *OHS Regulation ("Regulation")* requires a hazard assessment and written confined space entry procedures be prepared by a "qualified person who has adequate training and experience in the recognition, evaluation and control of confined space hazards"

Section 9.11(2) of the *Regulation* states "For the purposes of subsection (1)(a) qualifications which are acceptable as evidence of adequate training and experience include

(a) certified industrial hygienist (CIH) or registered occupational hygienist (ROH) with experience in confined space entry,

(b) certified safety professional (CSP), Canadian registered safety professional (CRSP) or professional engineer (P. Eng.), provided that the holders of these qualifications have experience in the practice of occupational hygiene as it relates to confined space entry, or

(c) other combination of education, training and experience acceptable to the Board."

Purpose of guideline
The purpose of this guideline is to provide direction to employers on how to meet their obligations to select qualified persons to create confined space hazard assessments and work procedures. It also provides contact information on some of the accrediting agencies that issue professional certifications referenced in section 9.11.

Employer due diligence
Employers are responsible for selecting qualified persons, as defined in s. 9.11 of the *Regulation*, to undertake confined space hazard assessments and written entry procedures. The employer must exercise due diligence in the selection of the qualified person. This is especially necessary if the person being engaged does not hold one of the certifications or the license credentials specified in section 9.11(2) (a) or (b). While each case must be considered on its merits, reliance by an employer on a person holding a certification or license specified in section 9.11(2) as being a "qualified person" for the purposes of section 9.11 would normally be considered reasonable, however, due diligence in all cases includes a review of the person's experience as well as their accredited credentials.

Section 9.11(2)(c) permits persons not certified or licensed to be considered qualified for the purposes of this section. Anyone experienced, knowledgeable and capable of doing the required hazard assessments and writing appropriate safe work procedures may be considered to be a "qualified person." The education, training and experience required to complete a particular confined space entry assessment and to write appropriate procedures will depend on the complexity of each situation and the hazards to be controlled.

Factors employers should evaluate in determining whether a person selected to undertake the confined space hazard assessment and entry procedures under 9.11(2)(c) is qualified include:

- Specific education and training the person has received, and relevance to the industry or type of space the person will encounter
- Extent of experience with confined space entry relevant to the industry and type of space the person will encounter
- Experience with specific elements or tasks related to confined space entry, such as:
    - lockout and isolation
    - air monitoring
    - ventilation
    - use of lifeline, harness and lifting equipment
    - the use of personal protective equipment
    - participation in rescue drills
    - previous assessments conducted and procedures written.
- Proficiency with applying exposure limits

A deficient confined space risk assessment or work procedure may be an indication the person selected was not qualified to do the hazard assessment and/or develop the written confined space entry procedures. In all such situations, whether the person selected purports to be a qualified person under subsection (a), (b) or (c), prevention officers will enquire what steps the employer took to assess the person's qualifications. It should be noted that when evaluating the qualifications of a person who has prepared a hazard assessment and confined space procedures, the officer's primary focus will be the quality of the assessments and procedures rather than the person's credentials.

Where prevention officers encounter hazard assessments and work procedures that are deficient and the person selected meets the definition of "qualified person" in s. 9.11 (2) (a) or (b), the employer who engaged the "qualified person" may file a complaint with the accrediting agency.

Note that in addition to engaging qualified persons, employers are also responsible for ensuring that the confined space hazard assessment contains the required elements, and that the written confined space entry procedures have been developed based on the hazard assessment (see s. 9.9(2) and s. 9.10).

Prevention officers will also assess the extent to which the employer knew or should have known that the assessment and/or procedures were deficient. In particular, prevention officers will enquire into what steps the employer took to ensure that ss. 9.9 and 9.10 were complied with.

Contact with accrediting agencies
Among other things, accrediting agencies often maintain web sites with contact information on accredited persons. For example, the Canadian Registration Board of Occupational Hygienists maintains contact information on persons with ROH's, which can be accessed at http://www.crboh.ca. A list of persons with CIHs can be found on the American Board of Industrial Hygiene web site at http://www.abih.org. Lists of persons with CRSPs, which are issued by the Board of Canadian Registered Safety Professionals, are available at http://www.bcrsp.ca

G9.6 Administration

Issued August 1, 1999

Section 9.6 of the *OHS Regulation* states "The employer must assign overall responsibility for administration of the confined space entry program to a person or persons adequately trained to do so."

The administration of the program required by section 9.5 may be undertaken by the employer's own staff, or it may be assigned to another person or persons. The person(s) appointed responsible for administration of the program must be given the authority and means to ensure the effective operation of the program.

G9.7 Supervision

Issued August 1, 1999

Section 9.7(1) of the *OHS Regulation* states "The employer must assign responsibility for supervision to a person who is adequately trained to supervise the job before any worker enters a confined space."

Section 9.7 requires the supervision of a worker entering or working in a confined space. Section 9.7(2) describes some specific duties of the supervisor. Section 9.6 requires the employer to assign someone responsible for the administration of the employer's overall confined space program. This division of responsibility may require the program administrator(s) and the supervisor(s) to carry different levels of authority within the program for its efficient operation. The administrator may also fulfill the responsibilities of the supervisor. This may be the case in smaller operations.

G9.8 Instruction

Issued August 1, 1999

Section 9.8 of the *OHS Regulation* requires that all persons who are "assigned duties or responsibilities related to entry into a confined space must be adequately instructed and trained". Specific training is required for persons contributing to the work activity, even those not entering the confined space, for example, standby workers and rescue workers.

G9.42 When required

Issued August 1, 1999

Section 9.42(4) of the *OHS Regulation* states "The use of a lifeline is not required if the risk assessment identifies obstructions or other conditions that make its use impractical or unsafe".

"Risk assessment" refers to the "hazard assessment" done under section 9.9.

G9.43 Standards

Issued August 1, 1999

Section 9.43 of the *OHS Regulation* states "Harnesses, lifelines and lifting equipment must meet the requirements of standards acceptable under this Regulation".

This primarily refers to the standards accepted under parts 4,8,11 and 32 of the *OHS Regulation*.

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G9.2 General Requirements - Initial determination

Issued August 1, 1999; Editorial Revision November 23, 2006

Section 9.2 of the *OHS Regulation* requires the employer to identify each confined space and determine whether it will require worker entry.

Compliance will require a site inspection/survey. The results of the inspection/survey are then used as the basis for action under sections 9.3 to 9.5, depending on whether workers must enter the confined space or not.

Section 9.2 is a specific requirement and supplements the general requirement to inspect the workplace under section 3.5 of the *OHS Regulation*. The results of an inspection/survey done for compliance with section 9.2 should be documented as required by paragraph 3.3(f) of the *OHS Regulation*. General workplace inspections, required by section 3.5, should include regular review of the status of compliance with Part 9 Confined Spaces.

G9.3 Prohibited entry

Issued August 1, 1999

Section 9.3 states "If a confined space exists at a workplace but no worker entry is required, the employer must ensure that each point of access to the confined space is secured against entry or identified by a sign or other effective means which indicates the nature of the hazard and the prohibition of entry, and that workers are instructed not to enter."

In some circumstances, use of signs or securing a confined space may be impracticable, for example, for sewer manholes on roadways. Examples of "other effective means" of identification are colour coding and mapping of locations on plans, or using descriptors of covers, manholes and inspection ports in worker education.

The end result should be that workers are able to identify all confined spaces at their workplace, understand the hazards of these spaces and any prohibition of entry. Hazardous areas not intended to be accessible to workers should be secured as required by section 4.34 of the *OHS Regulation*. For example, a sewer manhole on a road has a cover that is heavy and usually requires a tool for removal, thus it is generally secure against entry by anyone without an appropriate tool to lift the lid off.

G9.4 Control of hazard

Issued August 1, 1999

Section 9.4 of the *OHS Regulation* states "The employer must ensure that all confined space hazards are eliminated or minimized and that work is performed in a safe manner."

This may require the employer to take measures in addition to the other requirements of part 9. The employer should consider alternative ways of doing the work that avoid or reduce the need to enter a confined space. For example, increasing the interval time between entries to perform routine maintenance in a confined space may be a way to reduce the overall total time workers must work in the space. New methods may eliminate or substantially reduce the need for a worker to enter a confined space. For example, consider an in-place cleaning system for tanks, such as brewery tanks, that flushes and cleans the tanks automatically. If either of these alternatives is practicable, they should be considered.

G9.5 Confined space entry program

Issued August 1, 1999

Section 9.5 of the *OHS Regulation* requires the employer to have and implement a written confined space entry program before a worker is required or permitted to enter a confined space. The section sets out detailed requirements for the program, which are largely the matters covered by the other sections in part 9 of the *OHS Regulation*. Aspects that should be addressed in the program and worker training are:

- a worker in a confined space is to immediately leave the confined space on being instructed by the standby person of a health or safety concern, and
- adequate procedures for preparing for entry into a confined space (for example, to cover the risk of dangerous contaminants flowing out of the entrance to the confined space when it first opened), as well as procedures for working inside the space.

Paragraph 9.5(c) specifies a list of topics to be addressed, where applicable, for each of the hazards identified under sections 9.9 and 9.10. Subparagraph (x) refers to "coordination of work activities". Coordination will be necessary if there are activities, either inside or outside the confined space that could affect the health and safety of any worker inside the space. Where the activities involve workers of more than one employer, section 3.3 of the *OHS Regulation* applies, and in the case of a "construction project", section 20.3.

G9.1-1 Excluded confined spaces

Issued July 21, 2005; Revised June 18, 2008; Revised June 8, 2011; Revised December 19, 2013; Revised March 31, 2015; Editorial Revision October 28, 2015; Revised November 2, 2016

Regulatory excerpt
Section 9.1 of the *OHS Regulation* ("*Regulation*") states:

> *"confined space"*, except as otherwise determined by the Board, means an area, other than an underground working, that
>
> (a) is enclosed or partially enclosed,

(b) is not designed or intended for continuous human occupancy,

(c) has limited or restricted means for entry or exit that may complicate the provision of first aid, evacuation, rescue or other emergency response service, and

(d) is large enough and so configured that a worker could enter to perform assigned work;

Purpose of this guideline
The definition of confined spaces in section 9.1 of the *Regulation* permits WorkSafeBC to determine certain spaces to not be confined spaces for the purposes of the application of Part 9 of the *Regulation*. The purpose of this guideline is to identify the types of spaces that WorkSafeBC has determined, as contemplated by the above definition, not to be confined spaces, and the criteria the employer must assess to exclude them. Also, it outlines the process for making the determination for other spaces.

Exclusion Criteria
Enclosed spaces that are not "confined spaces" for the purposes of the application of Part 9 must satisfy specific exclusion criteria.

To determine that a space is not a confined space, it must be identified as a space described in Column A and must meet all the criteria in Column B.

Column A	Column B
Spaces that may be excluded from Part 9, provided that **all** the criteria in Column B are met	Exclusion criteria
• Swimming pools • Crawl spaces under school portables or other non-industrial buildings • Excavations • Attic space • Open, unconnected wet wells or dry wells for storm or sewer hookups at new construction sites • Elevator shafts • HVAC plenums • Agricultural feed mixer wagons and trucks that are permanently open on top, and empty Note: Underwater spaces during occupational diving operations have special considerations, refer to section 24.17 of the *Regulation*, Safe diving procedures.	1. The design, construction, location, and intended use of these spaces will ensure these spaces are characterized by clean respirable air at all times. 2. The space must have an interior volume of not less than 64 cubic feet per occupant. 3. The space must have openings to the atmosphere that are known to provide natural ventilation. 4. There must be no potential for a high or moderate hazard atmosphere, as defined in section 9.1 of the *Regulation*, to exist or develop immediately prior to any worker entering the space or during any work within the space. 5. There must not be a need to mechanically ventilate, clean, purge, or inert the space prior to entry for any reason. 6. There must be no potential for a hazardous substance to migrate through any media (e.g., air, soil, conveyance, piping, or structure) to infiltrate the space. 7. The space must be free of residual material (e.g., waste, sludge, debris) that if disturbed could generate air contaminants that could immediately and acutely affect a worker's health. 8. There must not be any risk of entrapment or engulfment to workers entering the space. 9. The space must not contain, have introduced, or be adjacent to tools, equipment, or involve processes that could generate air contaminants that could immediately and acutely affect a worker's health.

Where all the exclusion criteria are met, an employer through consultation with a worker, worker health and safety representative, or joint committee may make a determination that the space is not a confined space for purposes of Part 9 of the *Regulation*, and document that decision. The employer is expected to have suitable knowledge and expertise in confined space identification and assessment otherwise the assistance of a qualified person should be sought.

Other hazards to be controlled
A determination must also be made whether or not the space may contain or may have contained a harmful substance (as defined in section 9.1 of the *Regulation*) before any workers enter the space. For example, a crawlspace that contains asbestos pipe insulation might be excluded using the criteria in the table above; however, workers would still have to wear appropriate personal protective equipment while working in the space.

Although an enclosed space might not be considered to be a "confined space," it may have other hazards that must be controlled. The other parts of the *Regulation* still apply and must be considered when planning entry and work in these spaces. Other relevant provisions that the employer needs to consider include the following:

- Lockout (Part 10)
- Working Alone (Part 4)

- Occupational First Aid (Part 3)
- Personal Protective Clothing and Equipment (Part 8)
- Diving Operations (Part 24)

Determination regarding other spaces
WorkSafeBC may determine other types of spaces to be excluded from the application of Part 9 of the *Regulation* which do not meet the exclusion criteria or include spaces where an employer proposes to perform work that will generate air contaminants. Such determinations will be made based on an evaluation by a committee of WorkSafeBC personnel with expertise in confined spaces.

Persons interested in having WorkSafeBC assess whether a certain type of space should be determined not to be a confined space for the purposes of Part 9 of the *Regulation* may contact the Prevention Practices and Quality Department or the WorkSafeBC office in their region.

G9.1-2 Definitions

Issued August 1, 1999; Revised February 11, 2004; Revised April 9, 2008; Revised August 23, 2011; Editorial Revision consequential to August 4, 2015 Regulatory Amendment; Revised November 2, 2016

Regulatory excerpts
Section 9.1 of the *OHS Regulation* ("*Regulation*") states:

> "*confined space*", except as otherwise determined by the Board, means an area, other than an underground working, that
>
> (a) is enclosed or partially enclosed,
>
> (b) is not designed or intended for continuous human occupancy,
>
> (c) has limited or restricted means for entry or exit that may complicate the provision of first aid, evacuation, rescue or other emergency response service, and
>
> (d) is large enough and so configured that a worker could enter to perform assigned work;
>
> "*high hazard atmosphere*" means an atmosphere that may expose a worker to risk of death, incapacitation, injury, acute illness or otherwise impair the ability of the worker to escape unaided from a confined space, in the event of a failure of the ventilation system or respirator
>
> "*low hazard atmosphere*" means an atmosphere which is shown by pre-entry testing or otherwise known to contain clean respirable air immediately prior to entry to a confined space and which is not likely to change during the work activity, as determined by a qualified person after consideration of the design, construction and use of the confined space, the work activities to be performed, and all engineering controls required by this *Regulation*;

Purpose of guideline
This guideline provides information to further explain some of the terms that appear in 9.1 (Definitions) of the *Regulation*. Matters discussed include

- Underground workings
- Not designed or intended for continuous human occupancy
- Restricted means for entry or exit
- Entering the space
- High hazard atmosphere
- Low hazard atmosphere

1. Underground working
The definition for "confined space" in section 9.1 of the *Regulation* excludes underground workings. An underground working is defined in section 22.1 of the *Regulation*, as including "any adit, tunnel, underground excavation, chamber, caisson, raise, shaft, winze or natural entry." The exclusion applies while the underground area is under construction. Once construction is complete, the underground area will be a confined space if it meets the criteria listed in paragraphs (a) to (d) of the definition for confined space in section 9.1.

2. Not designed or intended for continuous human occupancy
According to the definition of a confined space in section 9.1 of the *Regulation*, if an enclosed or partially enclosed space is designed or intended for continuous human occupancy, then it is not a confined space. When identifying confined spaces for the purposes of Part 9, an employer needs to include the following principles in determining whether each space is designed or intended for continuous human occupancy.

If a space is designed or intended for continuous human occupancy, it will generally:

- Incorporate a permanent Heating, Ventilation and Air Conditioning (HVAC) or similar system
- Rely in its design on relevant codes as applicable, including the *BC Building Code*, *National Fire Code*, *BC Electrical Code*, *BC Plumbing Code*, *Mechanical Refrigeration Code*, and municipal by-law requirements
- Include installed utility services that anticipate human occupancy e.g., hard-wired lighting rather than portable lamps, plumbed water lines

rather than hoses etc.
- Not be designed as a container or conveyance of a product or substance
- Be entered for purposes other than periodic inspection, maintenance, repair or construction
- Include designed access and egress means such as doorways and staircases
- Incorporate features intended solely to accommodate continuous occupancy e.g., have amenities associated with continuous occupancy such as furniture, flooring material, wall coverings
- Be designed to allow worker self-rescue if there is a failure of the above features.

A space needn't have all the features described above in order to be designed or intended for continuous human occupancy. The more of these characteristics that are included in the design and use, the more likely the space will be considered to be designed and intended for continuous human occupancy and therefore not fall within the definition of a confined space.

3. Restricted means for entry or exit
To be considered a confined space, a work area must meet *all* four criteria in the definition. A criterion that often raises questions is paragraph (c), which addresses limited or restricted means of entry or exit that may complicate the provision of emergency response.

Entry or exit refers to crossing the portal between the confined space and the outside work area, but also includes consideration of the routes inside the confined space for gaining access to the work area in the space, or returning to the portal from it.

Criterion (c) lists four types of emergency responses.

- First aid, which refers to treatment for the purpose of preserving life and minimizing the consequences of injury until medical treatment is obtained, and treatment of minor injuries.
- Rescue, which involves removing a worker or workers from danger, in circumstances where they have become incapable of removing themselves.
- Evacuation, which refers to the exit of the entire workforce from the work area in an emergency situation.
- Other emergency response, which includes scenarios such as firefighting, and hazardous materials spill response.

The issue in paragraph (c) is whether the means of entry or exit "may complicate" the provision of one or more of the four types of emergency response. Some factors to consider for different types of emergency situations are provided below.

First aid and rescue: First aid and rescue are often closely related in practice. First aid includes both injury treatment and preparation of an injured worker for transport on a device such as a spine board, stretcher, sked, or ked. Rescue may involve some initial injury treatment at the site of injury, and will always involve removal of a worker from danger, for example, by use of a transport device, or other means such as a lifeline and harness. When carrying a worker on a transport device the normal practice for the response team is to carry it at about hip level with the arms of the bearers extended downward.

The following are *some* examples of situations where the means of entry or exit will typically be considered to have complicated the provision of first aid or rescue:

- A space for which the means of exit prevents the use of a first aid transport device, and requires a worker to be removed from the space by other means such as a harness, lifeline, and possibly a lifting device.
- A space in which circumstances impede the ability to transport an injured worker. For example:
    - The exit port of the space is narrower than the width of the transport device.
    - The exit port is so constructed that a person carrying the device has no alternative but to put it down in order to get through the port or pass it to another person through the port.
    - The transport device needs to be lifted at any time to shoulder height or higher when exiting the space with the injured worker in it. (Such lifting might be needed, for example to get a stretcher over top of a piece of machinery on the way to the exit port, or if the exit port was well above floor level and access on a stairway or ramp was not possible.)
    - The transport device needs to be inclined at any time to an angle of 45 degrees or more above horizontal. (This might occur, for example, when easing the device up to the exit port and out of the space.)
    - Specialized equipment such as a block and tackle or other equipment is *necessary* during the exit scenario to lift or direct the transport device.
- A space with a potentially dangerous atmosphere and a means of entry or exit that is so constructed that first aid or rescue workers wearing self-contained breathing apparatus (SCBA) must remove tanks from their backs at any point when entering or exiting.

Evacuation: Whether or not the means of exit may complicate the evacuation of workers from a space will typically depend on factors such as the potential speed of onset of danger, the number of workers in the space, and the obstacles they may encounter when exiting.

If there is the potential for rapid onset of danger, for example, from release of a flammable or toxic atmosphere into the space, it is essential that exits are sufficiently accessible so that workers can exit the space without any delay, regardless of the number of workers. If the impediments to evacuation would result in any delay then the means of exit will be considered to have complicated the capability to evacuate the space.

On the other hand, a space may be one in which the onset of danger would be slow, for example, where the danger could arise from water flowing through a small diameter pipe into a large space, at such a low rate that any danger to workers would only occur after a considerable period of time. In such cases, it may be safe for workers to evacuate the space over a longer period, as long as the evacuation was done in a timely manner,

and the time needed did not compromise the safety of any worker.

Other emergency response services: Depending on the space, other emergency response scenarios could include services such as fire fighting or controlling hazardous material spills. If emergency response workers in these situations would need to wear an SCBA or other personal protective gear, and the means of entry or exit is so constructed that any of the gear must be removed when entering or exiting, then the provision of the emergency response will have been complicated by the means of entry and exit.

4. Entering the space
Paragraph (d) of the definition for confined space in section 9.1 requires that the area in question be "large enough and so configured that a worker could enter to perform assigned work." A worker should be considered to have entered a confined space when the breathing zone of the worker crosses the plane of the confined space access.

5. High hazard atmosphere
The exposure limits in the Table of Exposure Limits for Chemical and Biological Substances (refer to OHS Guideline G5.48-1) are not used to define the boundary between a moderate and high hazard atmosphere confined space. Section 1.1 of the *Regulation* defines IDLH atmosphere as "an atmosphere containing a substance at a concentration which is immediately dangerous to life or health (IDLH) because the concentration is greater than that from which one could escape without any escape-impairing symptoms or irreversible health effects, and includes an atmosphere with an unknown concentration with the potential to be immediately dangerous to life or health."

IDLH levels for specific contaminants are available from sources such as *Documentation for IDLH Concentrations, NIOSH May 1994,* or may be specified on the SDS for the substance. An atmosphere meeting this definition would be high hazard under section 9.1. However, the definition of high hazard also covers other situations. In determining whether a confined space contains a high hazard atmosphere, consideration should be given to

- The space's original atmospheric conditions
- The contaminants that will be generated by the work to be done in the space
- The ventilation or other engineering controls applied to remove or reduce the level of contaminants
- The rate at which the atmosphere will deteriorate on failure of the engineering controls
- The ability to recognize failure of engineering controls
- The time required for a worker to leave the space unaided

The atmosphere will generally be classified according to the level of contaminants after the application of engineering controls. However, if on failure of the controls, the level of contaminants may increase at a rate that will prevent the worker from escaping unaided, the atmosphere is high hazard.

6. Low-hazard atmosphere
The definition of low hazard atmosphere includes a reference to a qualified person. Qualified is generally defined in section 1.1 of the *Regulation*. However, the determination whether an atmosphere is low hazard is part of the hazard assessment required to be done by a qualified person under sections 9.9 and 9.11. Section 9.11 sets out specific requirements for who is a qualified person for this purpose. Refer also to OHS Guideline G9.11.

The definition also refers to "an atmosphere which is shown by pre-entry testing or otherwise known to contain clean respirable air…." Paragraph 9.25(7)(c) states "Pre-entry atmospheric testing is not required in a confined space with a low hazard atmosphere if...prior representative sampling has demonstrated that the atmosphere within the space or group of similar spaces meets the low hazard atmosphere definition." Refer also to OHS Guideline G9.25. This sampling will commonly be the basis for it being "otherwise known" that a space contains clean respirable air.