



NATT Safety Services Confined Space Entry & Awareness

Objectives

By the end of this program you will have knowledge of the following:

- Definitions in Relation to Confined Space
- Legislative Requirements (213/91 & OHSA)
- Roles and Responsibilities
- Relative Confined Space Hazards and Descriptions

All participants must pass a written exam with a passing grade of 80%, upon completion you will receive a wallet size training certificate.

Definitions

The following definitions are quoted from Occupational Health and Safety Act and Regulation for Construction Projects O. Reg. 213/91.



Definitions

Assessment:

means an assessment of hazards with respect to one or more confined spaces in a workplace, as described in section 6

Attendant:

An attendant is a worker who is trained of the hazards in a confined space and whose primary responsibility is to monitor the workers in the confined space and perform the defined duties.

- monitors the entrant(s) (worker inside)
- monitors area “outside” as well in the immediate surrounding area.

Definitions

Atmospheric Hazards:

“atmospheric hazards” means,

- (a) the accumulation of flammable, combustible or explosive agents,
- (b) an oxygen content in the atmosphere that is less than 19.5 per cent or more than 23 per cent by volume, or
- (c) the accumulation of atmospheric contaminants, including gases, vapours, fumes, dusts or mists, that could,
 - (i) result in acute health effects that pose an immediate threat to life, or
 - (ii) interfere with a person’s ability to escape unaided from a confined space

Definitions

Acceptable Atmospheric Hazards:

“acceptable atmospheric levels” means that,

- (a) the atmospheric concentration of any explosive or flammable gas or vapour is less than,
 - (i) 25 per cent of its lower explosive limit, if the worker is performing only inspection work that does not produce a source of ignition,
 - (ii) 10 per cent of its lower explosive limit, if the worker is performing only cold work,
 - (iii) 5 per cent of its lower explosive limit, if the worker is performing hot work,
- (b) the oxygen content of the atmosphere is at least 19.5 per cent but not more than 23 per cent by volume,

Definitions



Cold Work:

“cold work” means work that is not capable of producing a source of ignition

- i.e. High pressure wash

Hot Work:

“hot work” means work that is capable of producing a source of ignition

- i.e. Welding, grinding.
- *when performing hot work, the space must be continually monitored*



Definitions

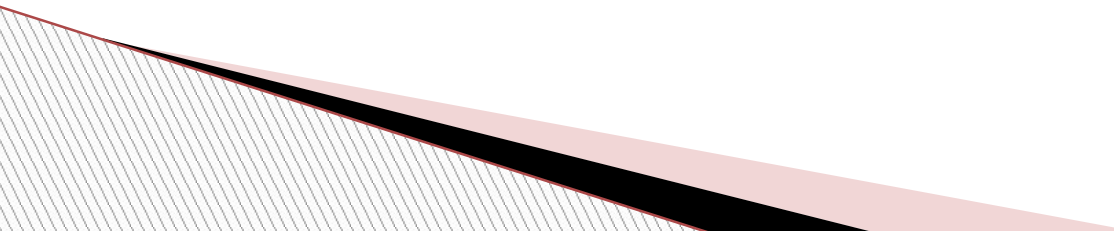
Confined Space:

“confined space” means a fully or partially enclosed space,

- (a) that is not both designed and constructed for continuous human occupancy, and
- (b) in which atmospheric hazards may occur because of its construction, location or contents or because of work that is done in it

Definitions

Identification and Classification of Spaces

- Some spaces do not meet the criteria for confined spaces, companies may call them a “Restricted Space”
 - If hazardous physical or chemical agents are introduced into the space as part of ongoing/related work, the space must then be designated as a ‘Confined Space’
 - A restricted space refers, in part, to a "space from which the egress of a worker is restricted, limited, or impeded". A “restricted space” may also be a confined space, thus, an evaluation of the space may determine that the area is either a confined space, a restricted space, or both.
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Definitions

Competent Person:

“competent person” means a person who,

(a) is qualified because of knowledge, training and experience to organize the work and its performance,

(b) is familiar with this Act and the regulations that apply to the work, and

(c) has knowledge of any potential or actual danger to health or safety in the workplace

Entrant:

Personnel that are qualified, and trained to perform work inside a confined space and knowingly understands the risks and hazards associated with the particular confined space.

Breaking the Plane

is when any part of the body passes through the opening of the confined space.

Definitions

Designated Substance:

“designated substance” means a biological, chemical or physical agent or combination thereof prescribed as a designated substance to which the exposure of a worker is prohibited, regulated, restricted, limited or controlled

Emergency Work:

“emergency work” means work performed in connection with an unforeseen event that involves an imminent danger to the life, health or safety of any person

Purging:

“purging” means displacing contaminants from a confined space;
 (“purge”)



Definitions

Employer:

“employer” means a person who employs one or more workers or contracts for the services of one or more workers and includes a contractor or subcontractor who performs work or supplies services and a contractor or subcontractor who undertakes with an owner, constructor, contractor or subcontractor to perform work or supply services

Lead Employer:

“lead employer” means an employer who contracts for the services of one or more other employers or independent contractors in relation to one or more confined spaces that are located,

- (a) in the lead employer’s own workplace, or
- (b) in another employer’s workplace

Definitions

Related Work:

“related work” means work that is performed near a confined space in direct support of work inside the confined space.

Supervisor:

“supervisor” means a person who has charge of a workplace or authority over a worker

Entry Coordinator

ensures all personnel that enter the confined space understand the entry requirements and comply with site policies, procedures and plans.

Definitions

IDLH:

Immediately Dangerous to Life and Health

Exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.

Definitions

LEL/LFL:

Lower Explosive Limit/Lower Flammable Limit

The lowest concentration (percentage) of a gas or a vapor in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The term is considered by many safety professionals to be the same as the lower flammable limit (LFL).

Definitions

UEL/UFL:

Upper Explosive Limit/Upper Flammable Limit

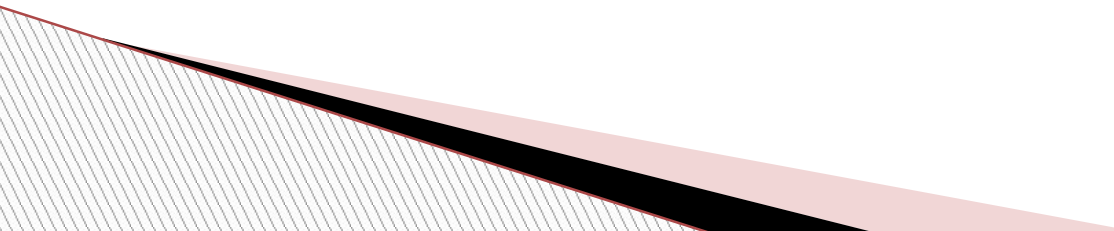
Highest concentration (percentage) of a gas or a vapor in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). Concentrations higher than UFL or UEL are "too rich" to burn.

Definitions

PEL:

Permissible Exposure Limit

Is the maximum amount or concentration of a chemical that a worker may be exposed to under OSHA regulations.



Definitions

PPM:

Parts Per Million

A common unit of measurement for toxic gases.

This term means one part out of one million possible parts.

Definitions

TLV:

Threshold Limit Value

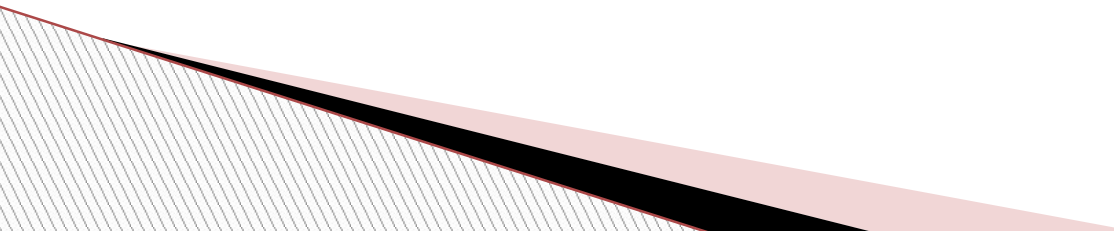
Of a chemical substance is a level to which it is believed a worker can be exposed day after day for a working lifetime without adverse effects.

Definitions

STEL:

Short Term Exposure Limit

is the acceptable average exposure over a short period of time, usually 15 minutes as long as the time-weighted average is not exceeded. STEL is a term used in occupational health, industrial hygiene and toxicology.



Definitions

TWA:

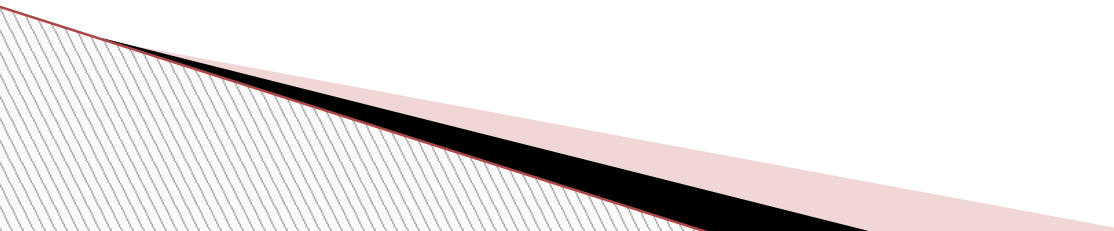
Time Weighted Average

are an average value of exposure over the course of an 8 hour work shift

Ceiling Values

at no time should this exposure limit be exceeded.

TWA levels are usually lower than ceiling values. Thus, a worker may be exposed to a level higher than the TWA for part of the day (but still lower than the ceiling value) as long as he is exposed to levels below the TWA for the rest of the day.



Definitions

Intrinsically safe:

is a protection technique for **safe** operation of electrical equipment in hazardous areas by limiting the energy, electrical and thermal, available for ignition.

Contaminant:

means a harmful or irritant material, nuisance dust, foreign to the normal composition of a substance, or a material that varies the normal proportions of components in a mixture such as air.

Definitions

Emergency Response Rescue Team

A combination of persons trained, equipped, and available to respond to confined space emergencies

Rescue Team Leader:

The person designated within the incident command system as the rescue teams leader responsible for delegation, and direct supervision of the emergency response team operations.

Legislative Requirements

Program

- (1) If a workplace includes a confined space that workers may enter to perform work, the employer shall ensure that a written program for the confined space is developed and maintained in accordance with this Regulation before a worker enters the confined space.
- (2) A program described in subsection (1) may apply to one or more confined spaces.
- (3) In the case of a workplace that is not a project, the program described in subsection (1) shall be developed and maintained in consultation with the joint health and safety committee or the health and safety representative, if any.
- (4) A program described in subsection (1) shall be adequate and shall provide for,

 - (a) a method for recognizing each confined space to which the program applies;
 - (b) a method for assessing the hazards to which workers may be exposed
 - (c) a method for the development of one or more plans
 - (d) a method for the training of workers, and;
 - (e) an entry permit system that sets out the measures and procedures to be followed when work is to be performed in a confined space to which the program applies.

Legislative Requirements

Program Continued

- (5) In the case of a workplace that is not a project, the employer shall provide a copy of the program to the joint health and safety committee or the health and safety representative, if any.
- (6) In the case of a workplace that is a project, the employer shall provide a copy of the program to the constructor, who shall provide a copy of it to the project's joint health and safety committee or the health and safety representative, if any.
- (7) The employer or constructor, as the case may be, shall ensure that a copy of the program is available to,
 - (a) any other employer of workers who perform work to which the program relates; and
 - (b) every worker who performs work to which the program relates, if the workplace has no joint health and safety committee or health and safety representative.

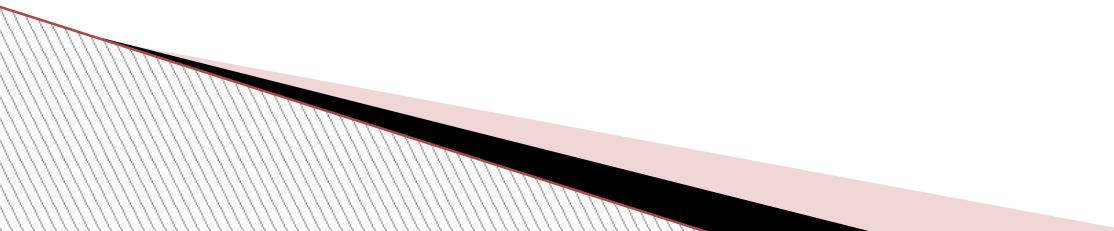
Legislative Requirements

Assessment:

- (1) Before any worker enters a confined space, the employer shall ensure that an adequate assessment of the hazards related to the confined space has been carried out.
- (2) The assessment shall be recorded in writing and shall consider, with respect to each confined space,
 - (a) the hazards that may exist due to the design, construction, location, use or contents of the confined space; and
 - (b) the hazards that may develop while work is done inside the confined space.
- (3) The record of the assessment may be incorporated into an entry permit under section 10.

Legislative Requirements

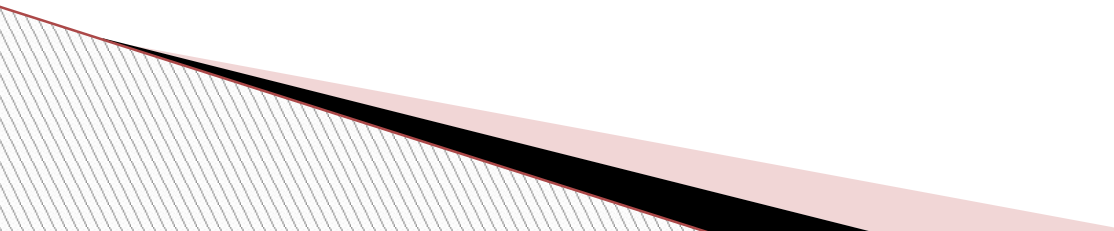
General Training

- (1)** Every worker who enters a confined space or who performs related work shall be given adequate training for safe work practices for working in confined spaces and for performing related work, including training in the recognition of hazards associated with confined spaces.
 - (2)** The employer shall appoint a person with adequate knowledge, training and experience to conduct the training.
- 

Legislative Requirements

Specific Training

The employer shall ensure that every worker who enters a confined space or who performs related work receives adequate training to perform the work safely, in accordance with the relevant plan.

- (a) the recognition of hazards associated with confined spaces;
and
 - (b) safe work practices for working in confined spaces and performing related work
- 

Legislative Requirements

Specific Training Continued

The employer shall maintain up to date written records showing who provided and who received training under this section and the date when it was provided.

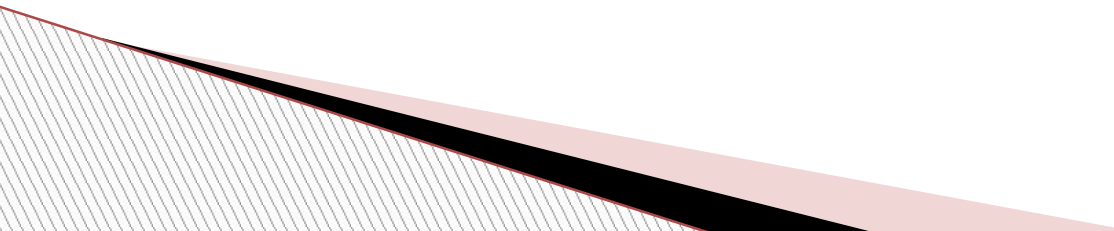


Legislative Requirements

Entry Permits

The employer shall ensure that a separate entry permit is issued each time work is to be performed in a confined space, before any worker enters the confined space.

An entry permit shall be adequate and shall include at least the following:

1. The location of the confined space.
 2. A description of the work to be performed there.
 3. A description of the hazards and the corresponding control measures.
 4. The time period for which the entry permit applies.
 5. The name of the attendant described in section 15.
- 

Legislative Requirements

6. A record of each worker's entries and exits.
7. A list of the equipment required for entry and rescue, and verification that the equipment is in good working order.
8. Results obtained in atmospheric testing under section 18.
9. If the work to be performed in the confined space includes hot work, adequate provisions for the hot work and corresponding control measures.

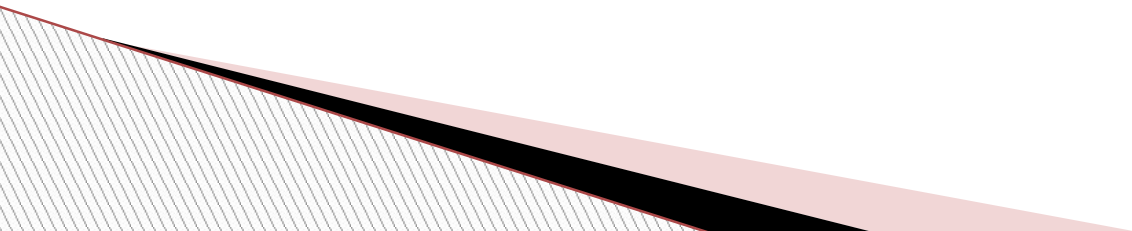
Before each shift, a competent person shall verify that the entry permit complies with the relevant plan.

The employer shall ensure that the entry permit, during the time period for which it applies, is readily available to every person who enters the confined space and to every person who performs related work with respect to the confined space.

Legislative Requirements

Preventing Unauthorized Entry

If there is a possibility of unauthorized entry into a confined space, the employer or, in the case of a project, the constructor shall ensure that each entrance to the confined space,

- (a) is adequately secured against unauthorized entry; or
 - (b) has been provided with adequate barricades, adequate warning signs regarding unauthorized entry, or both.
- 

Legislative Requirements

Atmospheric Testing

The employer shall appoint a person with adequate knowledge, training and experience to perform adequate tests as often as necessary before and while a worker is in a confined space to ensure that acceptable atmospheric levels are maintained in the confined space in accordance with the relevant plan.

If the confined space has been both unoccupied and unattended, tests shall be performed before a worker enters or re-enters.



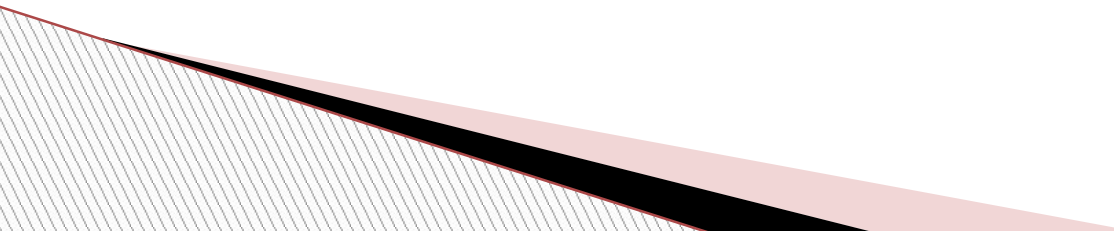
Legislative Requirements

The person performing the tests shall use calibrated instruments that are in good working order and are appropriate for the hazards identified in the relevant assessment.

The employer shall ensure that the results of every sample of a test are recorded, subject to subsection

If the tests are performed using continuous monitoring, the employer shall ensure that test results are recorded at adequate intervals.

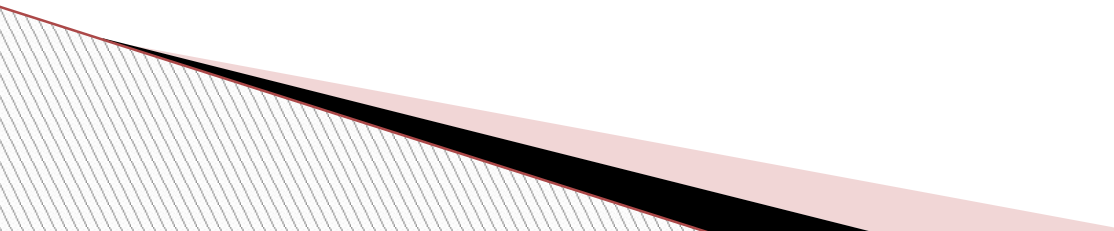
The tests shall be performed in a manner that does not endanger the health or safety of the person performing them.



Legislative Requirements

Attendant

Whenever a worker is to enter a confined space, the employer shall ensure that an attendant,

- (a) is assigned;
 - (b) is stationed outside and near,
 - (i) the entrance to the confined space, or
 - (ii) if there are two or more entrances, the one that will best allow the attendant to perform his or her duties
 - (c) is in constant communication with all workers inside the confined space, using the means of communication described in the relevant plan; and
 - (d) is provided with a device for summoning an adequate rescue response.
- 

Legislative Requirements

The attendant shall not enter the confined space at any time and shall, in accordance with the relevant plan,

- (a) monitor the safety of the worker inside;
- (b) provide assistance to him or her; and
- (c) summon an adequate rescue response if required

What is the importance behind this regulation?

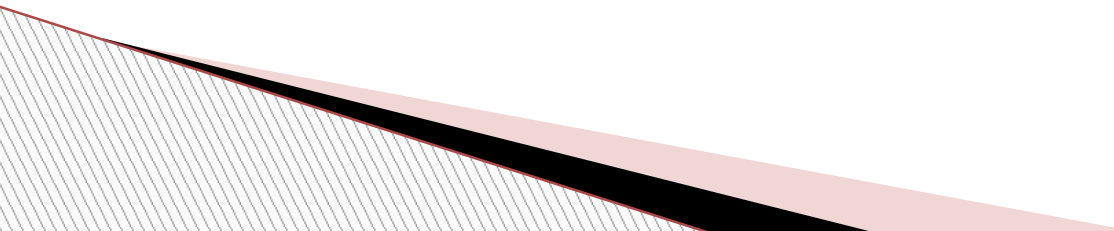


Roles Responsibilities

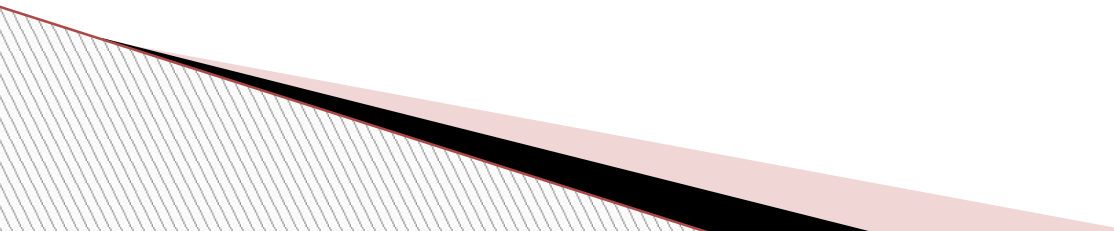
In the event of an emergency, all parties must know the following:

- INVAC “designated area indoors“ and OUTVAC “designated area outdoors “are called assembly areas. Your supervisor will need to account for all staff and take attendance.
- The nearest eyewash station, fire extinguisher, and portable shower (if applicable)
- The nearest exit, and an alternative exit route in the event that the primary route is obstructed or barricaded.
- Familiar with their location and confined space identification to summon on-site EMS.
- Contact information, control room, and first aid radio channels. (each site is different) Refer to site specific indoctrination and radio protocols. Radio check prior to each shift (if applicable)

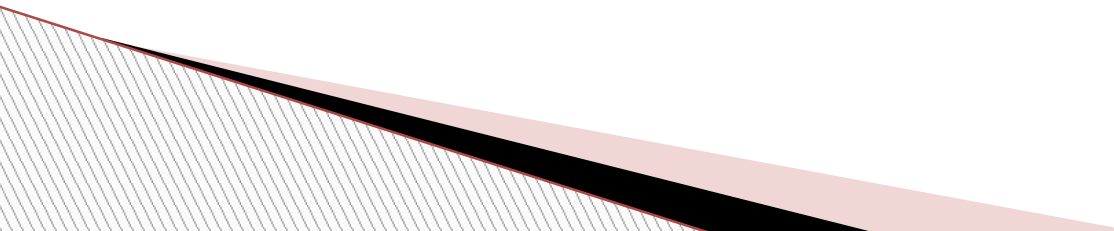
Roles and Responsibilities

- Attendant, rescuers and entrants must be aware of external and internal hazards associated with the confined space.
 - In the event of an emergency, all necessary equipment needed to perform a rescue must be inspected and in place prior to any confined space entry.
 - Attendant must **maintain communication** with entrants in the confined space at all times. If verbal or visual communication is not possible, you must implement an alternative method, such as- tapping on the side of the tank, air horn etc.
 - Continual or intermittent monitoring will be determined by the associated risks related to the confined space. The attendant must record results as described in the plan.
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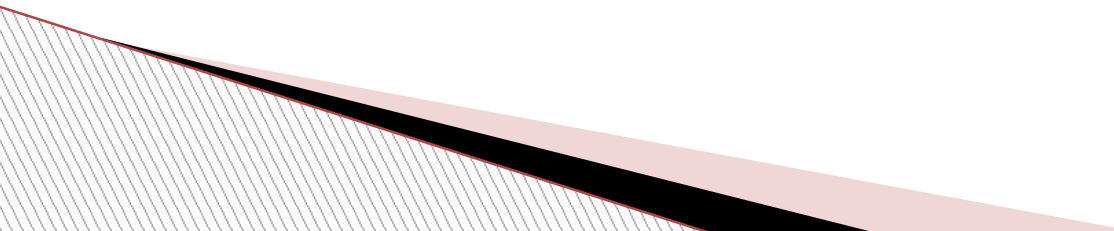
Roles and Responsibilities

- At no time must the attendant EVER enter or breathe the plane of the confined space.
 - The attendant must remain at the entrance while work is being performed inside.
 - If the attendant must be relieved, a qualified back up attendant must be assigned. Permit must reflect the attendant changes.
 - Attendant and rescuers must ensure that all confined space retrieval equipment has been inspected and in place prior to entry. (Often the rescue team lead will perform these inspections.)
- 

Roles and Responsibilities

- When the space is vacated, ensure the space has been barricaded and tagged with the appropriate contact information (if necessary) to prevent unauthorised entry.
 - Some confined spaces and/or workers require additional equipment to perform their work safely. All personnel shall ensure hoses, breathing air lines and ventilation tubing are not kinked or tangled.
 - Housekeeping is required by all parties involved with confined space, if something is obstructing your route of travel or creating a hazard near or around your confined space, ensure to speak to your contact and have it relocated.
- 

Roles and Responsibilities

- The attendant must keep unauthorized personnel away from the space. If a worker attempts to enter the space, ensure they have read and understood all proper documentation and permits, and have the necessary training.
 - If a hazard or atmospheric change occurs, the attendant must notify the entrants and evacuate the space as necessary.
 - The attendant has the absolute evacuation authority over the confined space
 - The attendant must track/log the entry and exits of each worker, this is a very important duty. In the event a worker has been exposed to a toxin or contaminant, investigators need to calculate how long the worker has been exposed.
- 

Duties and Responsibilities

DUTY/RESPONSIBILITY	ENTRANT	ATTENDANT	SUPERVISOR
Keep unauthorized entrants away from the space.		X	X
Remove unauthorized individuals who enter or who attempt to enter the permit space.			X
Communicate with entrants, monitor their status, and tell them when to evacuate.		X	
Inform the entrants and the entry supervisor if unauthorized persons enter the permit space.		X	
Communicate with the attendant regularly.	X		
Remain outside the space during entry operations until relieved by another attendant.		X	
Know the number and identity of authorized entrants.		X	
Use all equipment properly.	X	X	
Determine that acceptable entry conditions are maintained.			X
Exit from the permit space immediately given an order to evacuate, an alarm warning, or a sign of hazardous condition.	X		
Know permit space hazards, including the mode, symptoms, and consequences of exposure.	X	X	X
Notify the attendant of any signs or symptoms or exposure to hazardous conditions.	X		
Terminate the entry and cancel the permit when entry operations are finished or if a prohibited condition arises.		X	
Verify entry conditions are acceptable before signing the permit and allowing entry.			X
Perform non-entry rescues if necessary.		X	
Verify rescue services are available and the means for summoning them are effective.			X
Summon emergency responders when entrants need their services.		X	

Can you identify additional responsibilities in your workplace that are not shown on this chart?

Working at Heights

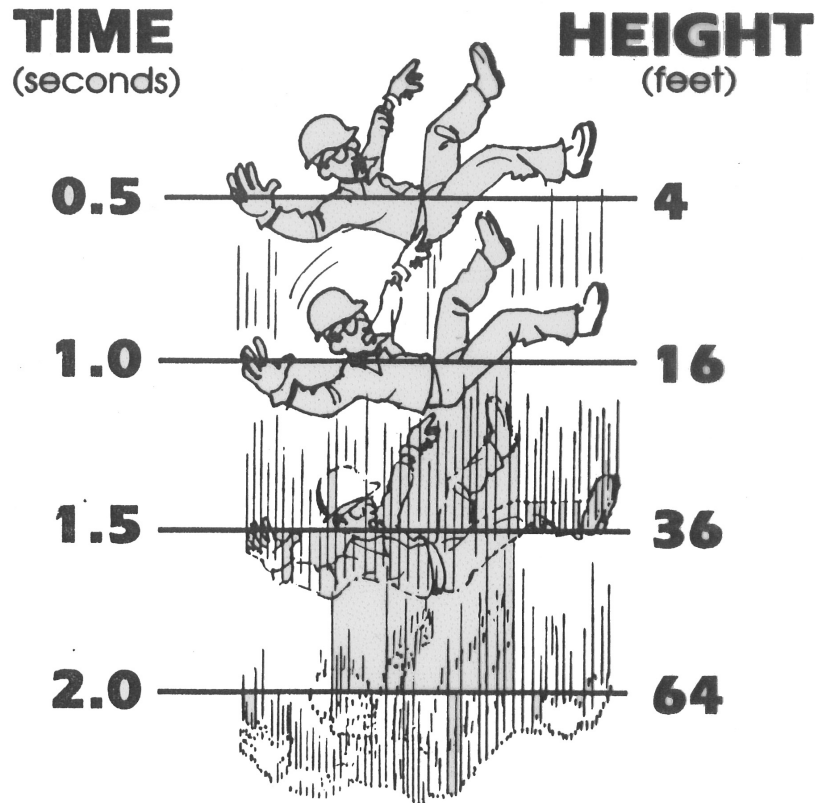
- ▶ We recommend all confined space personnel receive the Working at Heights training.
- ▶ Within the Working at Heights program, you will learn about barriers, warning signs, elimination controls, and how to protect yourself from fall hazards.

Hierarchy of Controls

- ▶ Eliminate or Substitute
- ▶ Passive Fall-Protection
- ▶ Active Fall Restraint
- ▶ Active Fall Arrest
- ▶ Administrative Controls

HOW FAST A BODY FALLS

At this speed, you most likely will not have enough time to grab hold of something or have enough time to regain balance to prevent a fall.

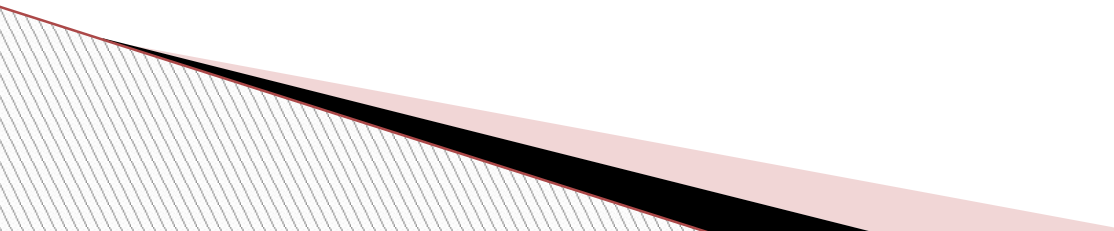


Plan Ahead

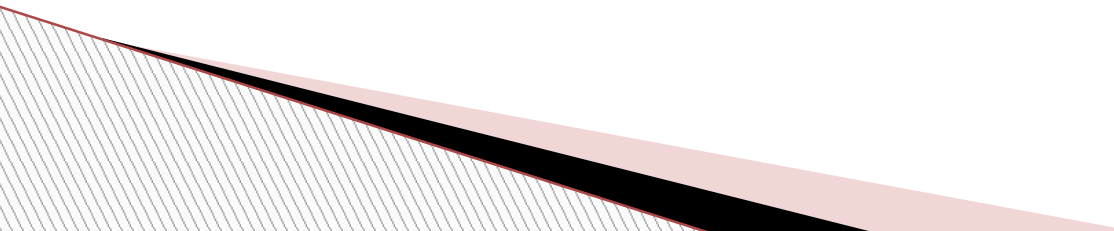
If having the right equipment is important, then being trained in using the equipment is even more important. Training and education are critical to developing safe confined space entry practices.

Even the best and most thoroughly maintained equipment cannot protect human life if the equipment is not used properly or is not used at all.

Likewise, establishing safety procedures and guidelines will not protect the workers if the procedures are not followed.



Rescue Planning

- ▶ If an incident occurs, any person must be rescued safely and quickly. Therefore, a **RESCUE PLAN** must be in place prior to performing any work at in a confined space. In fact, the rescue plan may influence the type of system that is used so the means of rescue should always be considered when selecting rescue/retrieval equipment for a job.
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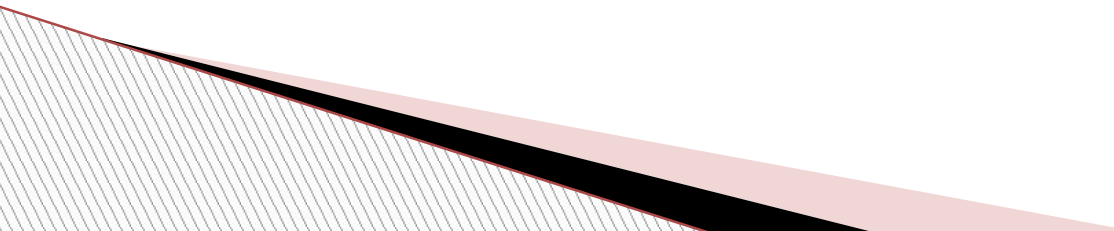
Considerations

2/3 of all confined space fatalities are would be rescuers, that's a shocking 60%.

Eliminating the need for rescue would decrease these fatalities

Proper work procedures can be implemented and adhered to, to reduce this requirement

Any confined space can be made safe with proper planning, tools, equipment and personnel



Plan Ahead

Experienced workers may take risks, which develop into unsafe behaviors over time.

They may gradually become complacent about safety or overconfident regarding the safety of a confined space.

If they've never encountered a hazardous atmosphere in their work experience, they may assume that an accident will never happen and or never happen to them.

***click on picture to watch video ***



CONFINED SPACE FATALITIES!

ACCIDENT ALERT

Four Workers Die in Confined Space

A health and safety message from the WCB

In a recent accident, four workers died and two others were injured after they entered into the hold of a barge through a small hatch. This type of enclosed area is considered a confined space under the Occupational Health and Safety Regulation.

This alert provides links to resources to help you prevent confined space accidents in your workplace. Please pass this along to co-workers and friends who may find this useful.

A confined space is not normally designed or intended for human occupancy. If workers must enter a confined space, special precautions are required to protect them from flammable or harmful atmospheres, oxygen depletion or enrichment, or situations of possible entrapment.

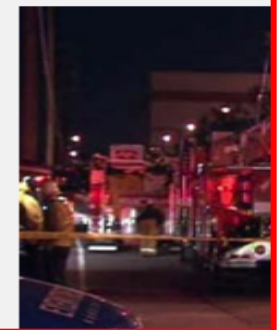
Examples of confined spaces include: tanks, silos, storage bins, process vessels, pipelines, sewers, double hulls, underground utility vaults, boilers, pits, and vats.

1 Dead, 2 Injured in Storage Tank Incident

Posted on [January 26, 2011](#) by [Francelle Theriot](#)

A man died Friday (January 21) after being overcome by fumes while trying to help two co-workers who lost consciousness inside a tank they were cleaning at a pharmaceutical plant north of Atwater Village, authorities said.

When Los Angeles firefighters arrived at the Baxter Healthcare Corp. about 4 a.m., one of the men had no heart rate and was



Fatality example:

On February 11, 2003, a 26-year old press operator with 2 years 4 months mining experience was fatally injured at a surface clay operation.

He was performing cleanup inside a reaction tank when a steam injection line activated, engulfing him in high-pressure steam.

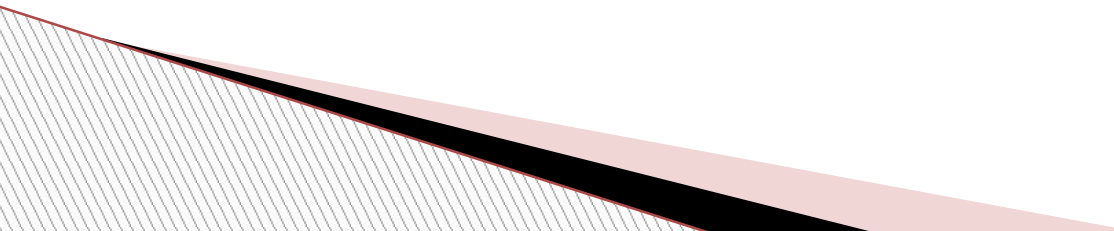
The automatically activated electronic control for the steam injection line had not been locked out, nor had the manual gate valve for the steam line been closed and locked prior to his entering the tank.

The victim had no prior experience performing this task.



Why do Confined Space accidents happen?

Research suggests some of the following can be contributing factors:

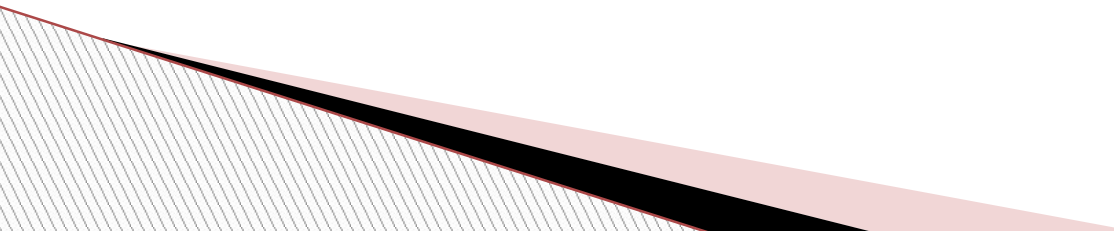
- ▶ Improper planning
 - ▶ Inexperience
 - ▶ Complacency
 - ▶ Untrained Individuals
 - ▶ Short cuts
 - ▶ Improper or defective tools/equipment
 - ▶ Incomplete locking and tagging
- 

Put your knowledge to the test

How would you define a confined space?

What are some of the hazards that may be found in a confined space?

Don't limit your answers to your site specifically, think about confined spaces in other industries.



What are some typical examples of confined spaces?

- ▶ Silo's
- ▶ Bin's
- ▶ Hoppers
- ▶ Dust collector
- ▶ Tank's
- ▶ Sump's
- ▶ Sewers
- ▶ Pit's
- ▶ Trenches
- ▶ Manholes
- ▶ Furnaces
- ▶ Chute's
- ▶ Duct's

***can you identify confined spaces
in your work place?***

Air Monitoring Requirements

Because confined spaces may contain explosive, toxic, or oxygen-deficient/enriched atmospheres, they must be tested to verify that the required precautions for the identified hazards have been effective at being eliminated or controlled and that the atmosphere is safe for a worker to enter a confined space.

click on “test to live” to watch video

[Confined Space: Test to Live](#)



Oxygen Deficiency

What can cause oxygen deficiency? (oxygen below 19.5%)

Consumption:

The person in the confined space can consume the oxygen
– as it is turned into carbon dioxide

Displacement:

Denser materials push the oxygen out of the confined space
i.e. – purging with gases that are heavier than air

Chemical Reaction:

Oxygen is consumed through chemical reactions
(i.e.. Oxidation or **Rusting**)



Oxygen Enrichment

Dramatically promotes and accelerates combustion

Never use O₂ to ventilate a confined space

23%(+) is considered Oxygen Enrichment



History

Some of the 1st attempts to detect toxic atmospheres came in coal mines. Coal mines are notorious sources of combustible and toxic gases as well as low oxygen levels.

Open flame lamps served as some of the first detection systems.

- low oxygen = flame to burn low
- combustible gases = flame to burn more brightly.

However, too much combustible gas resulted in the very explosion that they were trying to be



“Miners Safety Lamps”

- *Humphry Davy - 1855,*
- *Mr. T Gray - 1868*

History

In the 20th century, another detection method used in coal mining applications, was the...

- small caged birds were used to detect toxic environments (famous “miners canary”)
 - concept was that the birds would exhibit the effects of the toxic work environment before they could injure humans.
 - a healthy bird at the beginning of the work period was a vital requirement.



While effective in certain applications, these birds were not capable of detecting all hazardous conditions.



Gas Detection Equipment

There are many types of air monitoring instruments and devices manufactured for a variety of use in different work applications. Here are a few ways in which air can be monitored:

- stationary / fixed monitors,
- personal oxygen & gas badges,
- detector (colorimetric) tubes & pumps,
- hand held portable multi-gas monitors



Gas Detection Equipment

Air monitoring devices can be used for other reasons than testing the air quality in Confined Spaces. They also can be used for monitoring:

- Working environments like out in a plant. Example; where there is a lot of forklift traffic or in a mining, pulp/paper & oil refinery process type industries.
- For a potential “gas leak” in a pipe line.
- For the presence of an explosive gas in a process pipe line where “hot work” is about to be performed.

How Do The Instruments Work?

Instruments can sample the air and detect a variety of contaminant gases and vapors at incredibly small concentrations.

Some when activated, use a small air pump to draw a sample of air and analyze it for the target gas or vapor.

Most detectors have a digital readout that tells you how much of the contaminant gas and or oxygen that is present during the sampling.



LIMITATIONS

There may be other components in the air that you can't detect with a gas monitor because they are not gases. Examples:

- ▶ **Mists, or liquids** that have been turned into tiny droplets that float in the air. They're still in the liquid state, but the droplets are so small that they act almost like a gas, if they're flammable, they can be readily ignited.
- ▶ **Dust**, tiny particles of any solid substance. It, too, floats in the air and, at the wrong concentration, can be ignited (especially if it's, wood or coal dust or flour or sugar or even powdered aluminum).
- ▶ **Fumes** -- tiny particles of solids, often produced by processes such as welding, that can be inhaled.



Understanding LEL / UEL

LEL: The lowest concentration (air-fuel mixture) at which a gas can ignite is called lower explosive limit.

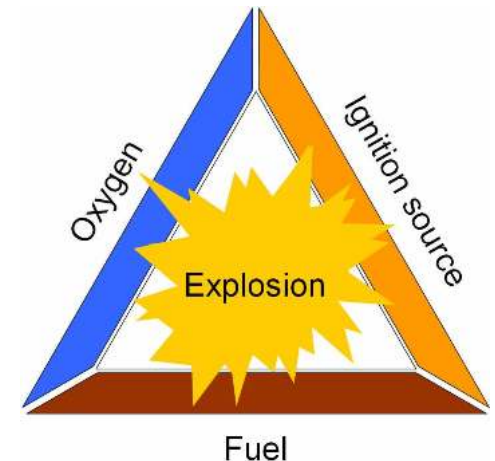
Concentrations below this limit are too lean to burn.

UEL: The highest concentration that can be ignited is its upper explosive limit.

Above that concentration, the mixture is too rich to burn.

click on “painting accident” to watch video

[Painting Accident](#)



Use of Solvents

Many solvents, such as kerosene, gasoline, paint strippers, degreasers, etc. are not only flammable, but are toxic as well and if inhaled at “high” concentrations, can cause problems with the Central Nervous System.

The effect can include the following;

- dizziness,
- drowsiness,
- lack of concentration,
- confusion,
- headaches,
- coma & death.



Ventilation

There are four main types of ventilation techniques that can be used to ventilate confined spaces:

- Supply positive pressure ventilation
- Local negative pressure ventilation
- Exhaust ventilation
- Positive-negative pressure ventilation



Ventilation

If you feel the ventilation in the space is inadequate, you can make recommendations to your supervisor or plant contact to have trained personnel install sufficient ventilation equipment.

Never tamper with existing ventilation.



Assessments

A competent person will be assigned to conduct a basic physical, chemical assessment and must possess the necessary qualifications to properly determine the present hazards associated with the space.

They must consider all process inputs and outputs to determine if:

- The identified chemicals present a hazard on their own, or
- Combinations of multiple chemicals contained within the space can cause a hazard to develop within the space.

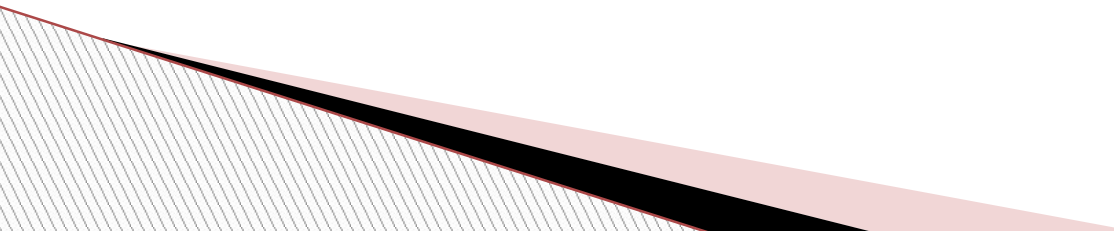


Assessments

If any controlled products are involved in a confined space, an SDS sheet must be reviewed to determine the risks to workers and possible interactions with other materials.

Flammable mixtures must be considered as well. Items such as oxygen, acetylene, hydrogen, hydrogen sulphide, carbon monoxide and certain dusts may present significant flammability hazards if not properly identified and controlled.

Potential chemical reactions occurring within the space will be considered in the assessment.



Assessments

Conditions of any toxicity chemicals or chemical combinations of oxygen enrichment or deficiency must be considered when assessment is being done so appropriate controls may be implemented prior to entry.

Atmospheric hazards identified, must be identified in the confined space assessment documents and included in the plan.

Before you can test the air in the confined space for the hazards identified, you must first “know what they are”.

If unsure of the hazards, consult with the contact or environmental group.



Air Testing Criteria

The person performing the confined space air monitoring, should get all of the necessary information from the company's confined space package after it has been completed by the assessors.

- What instrument(s) to use?
- What the instrument sensor configuration is going to be?
- Whether needing to perform continuous or periodic monitoring?
- Information of when instrument was last calibrated?
- Specific instructions for monitoring (if required)?
 - **Specific instructions or further information on proper monitoring techniques should be reviewed and discussed at the confined space pre-entry meeting.**

Where Can Confined Space Hazards Come From?

- physical nature of the space,
- work being performed,
- processes associated with the space,
- products used or produced in conjunction with the space,
- natural processes (such as decomposition, fermentation, etc.), which occur in or are associated with the space,
- external sources of contamination.

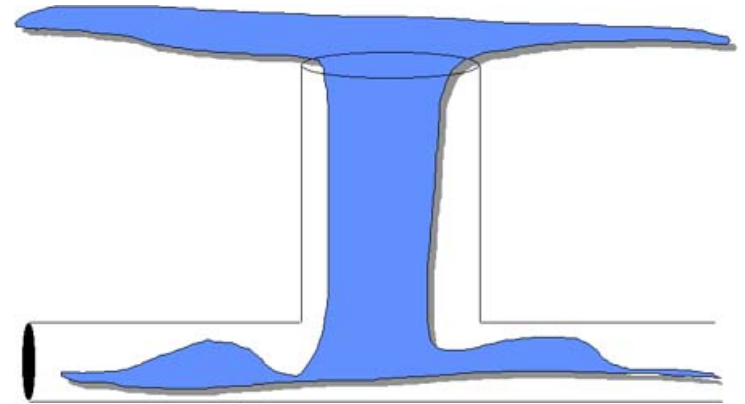
When assessing hazards, the company should always consider conditions and activities in other areas and their potential impact on the atmosphere in the space.



Engulfment Hazards

Flowing substance

- Loose, granular materials stored in bins and hoppers
- Flooding
- Products filling or removal
- Shifting contents



Entrapment

Many workplaces contain spaces that are considered “confined” because their configuration hinder the activities of any workers who must enter/exit to perform work.

For example, workers who work in process vessels must squeeze in/out through narrow openings and perform their tasks while cramped or contorted.

Other examples would be bends in tunnels, equipment obstructions, flu lines, ventilation units, baffles, agitators that can “trap” workers causing serious injury and endangerment.



Energy Source Hazards

- ▶ Electrical
- ▶ Hydraulic
- ▶ Mechanical
- ▶ Fire Control Systems
- ▶ Or pre-feed source to confined space.



Energy Source Hazards

Lockout-tagout (LOTO) or **lock** and **tag** is a safety procedure which is used in industry and research settings to ensure that dangerous machines are properly shut **off** and not able to be started up again prior to the completion of maintenance or repair work.



Medical Hazards

- ▶ Heart attack, stroke.
- ▶ Years of subjecting the workers to the hazards.
- ▶ Inexperience.
- ▶ Unexpected Occurrence



Temperature Hazards

Workers can be subjected to very warm temperatures within a confined space. This heat is caused by processes, personal protective equipment, product, or location of the confined space.

Heat stress can be reduced by proper ventilation, frequent rest periods, work regiments, and staying hydrated.

Similar dangers exist in a cold environment. When the body temperature decreases, a worker is subjected to frostbite and hypothermia. Frequent breaks to warm up and donning the proper clothing can assist in preventing cold stress.



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Falling Objects

Confined spaces with topside opening may expose workers inside to falling objects such as tools, loose material, equipment etc. Workers must be made aware of these potential hazards, and coordinate with other workers and work groups to prevent/ eliminate falling object hazards.

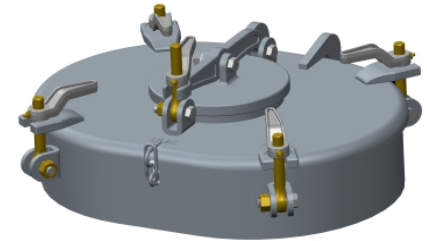


Access and Egress

An adequate means for entering and exiting shall be provided for all workers who enter a confined space in accordance with the relevant plan

Openings into a confined space must be large enough to permit the entry of workers wearing standard or specialized personnel protective equipment.

Hinged covers, man doors, ports, hatches etc. should be provided with a means whereby they can be locked, secured or stored in a safe position or manner.



Gases & Vapors

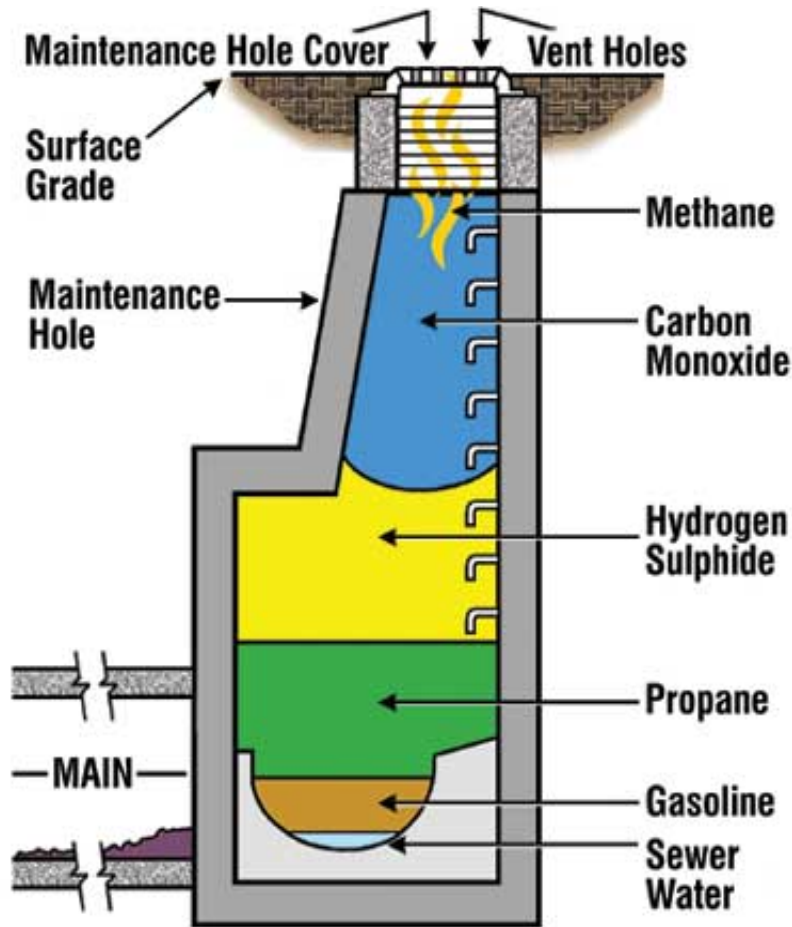
Because air does not move into and out of most confined spaces easily, hazardous gases can collect inside. Gases or vapors heavier than air can settle to the bottom and the gasses lighter than air can accumulate around the top. The oxygen content can be displaced, deficient, or enriched as a result of these gasses or vapors.

Do NOT assume if the air is safe in one area of the space, then it is safe everywhere else in the confined space!

Heavy & Light Gases

Heavier than air:

- ▶ *Hydrogen Sulfide*
- ▶ *Propane*
- ▶ *Carbon Dioxide*
- ▶ *Chlorine*
- ▶ *Solvents*
- ▶ *Liquid Hydrocarbons*



Lighter than air:

- ▶ *Hydrogen*
- ▶ *Methane*
- ▶ *Ammonia*
- ▶ *Nitrogen*
- ▶ *Carbon Monoxide*

DANGER!

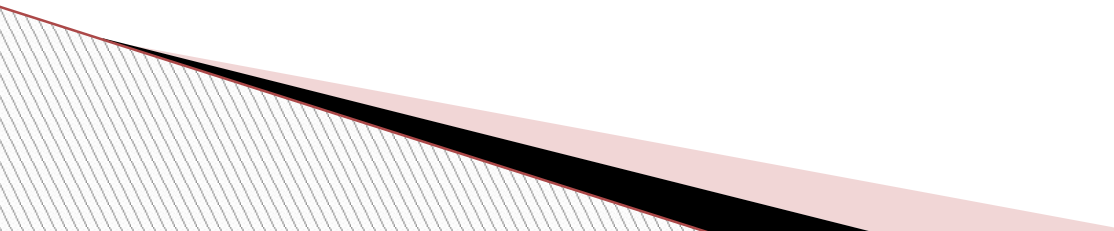
Never trust your senses to determine if the air in a confined space is safe.

You cannot see or smell many toxic or flammable gases and vapors, or sense the level of oxygen or combustible contaminants.



Evacuating the Confined Space

Everyone must exit the confined space when:

- the instrument goes into the alarm mode, indicating the air in the space is hazardous.
 - a warning sign or symptom of over exposure to a chemical or atmospheric hazard is recognized,
 - a unsafe work condition is detected, or a plant evacuation alarm is sounded.
 - the attendant has absolute evacuation authority over the confined space
- 

Knowing the risks associated with confined spaces, proper training, preparedness, as well as being competent in the use and operation of your instruments is vitally important in performing the roles and responsibilities of confined space air monitoring.

*** click on “precious time” to watch the video***

[Precious Time: Cody McNolty Story](#)



REMEMBER!

- ▶ If you can't get out, you can't go in.
- ▶ If you don't know, you don't go.

Theory Conclusion

Thank you for participating in the NATT Safety Services Confined Space Entry and Awareness training program.

You will receive a training certificate (wallet card) upon completion of this program.

