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confined space entry 101

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Confined space entry 101

- What is a confined space?
- I have to enter, how do I prepare for entry?
- What are required entry practices?
- What else is there to consider?

BC regulatory requirements

Occupational Health and Safety Regulations (OHSR)

- Part 9 Confined Spaces
- Part 9 OHSR Guidelines – Confined Spaces
(identified by “G” followed by section number)

**Session includes elements of OHSR Part 9 Confined spaces; similar requirements exist in the federal Canada Occupational Health & Safety Regulations and other provinces’ legislation (e.g., confined space definition)*

What is a confined space?

OHSR confined space definition

“...unless otherwise determined by the Board, means an area, other than an underground working, that

1. Is enclosed or partially enclosed,
2. Is not designed or intended for continuous human occupancy,
3. 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
4. Is large enough and so configured that a worker could enter to perform assigned work.”

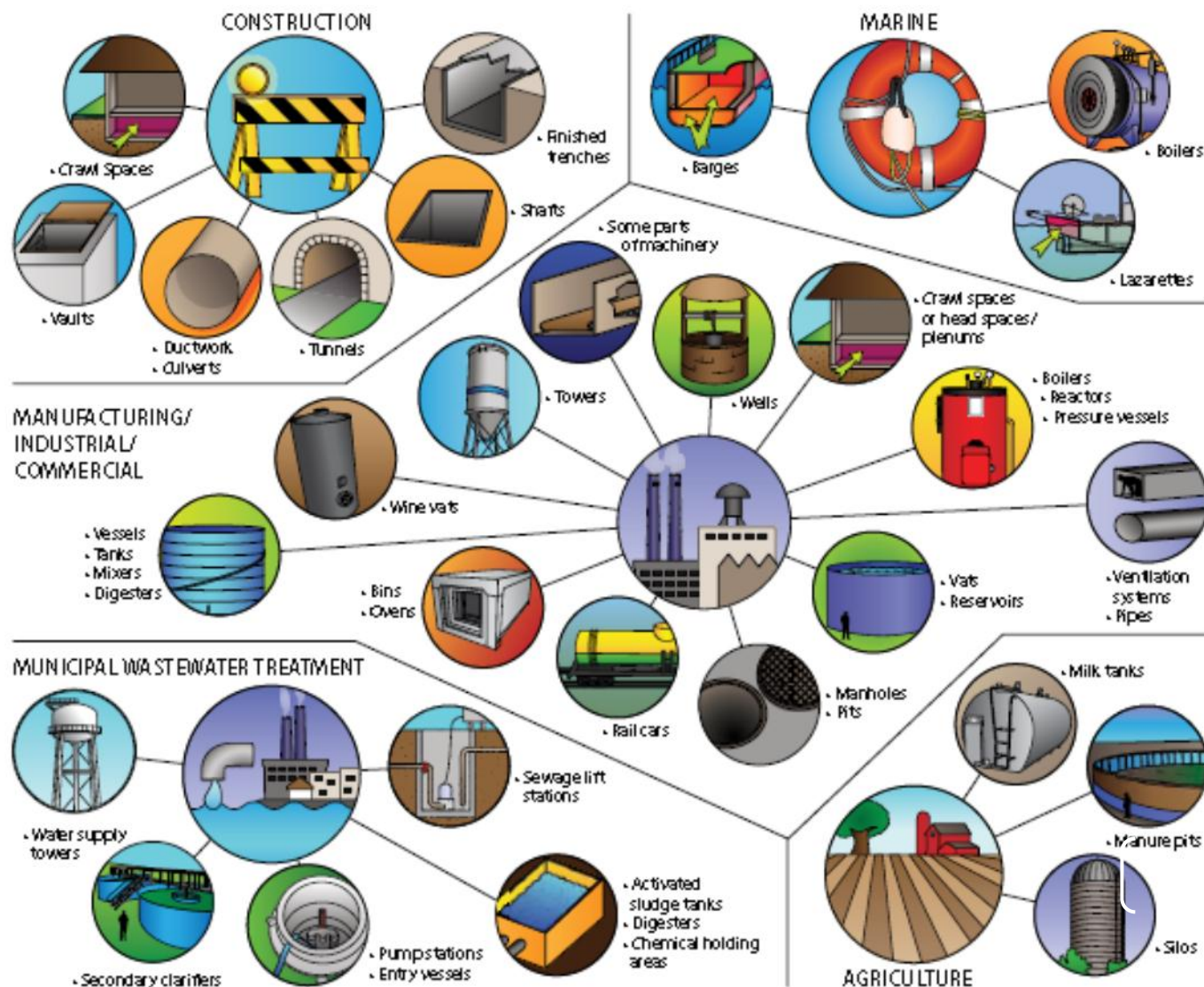
A space must contain all these characteristics in order for it to be considered a confined space.

CONFINED SPACES — DEADLY SPACES

A confined space is defined (according to the Regulation and unless otherwise determined by the Board) as any area other than an underground working that fits the following criteria: ① The area is enclosed or partially enclosed. ② It is not designed or intended

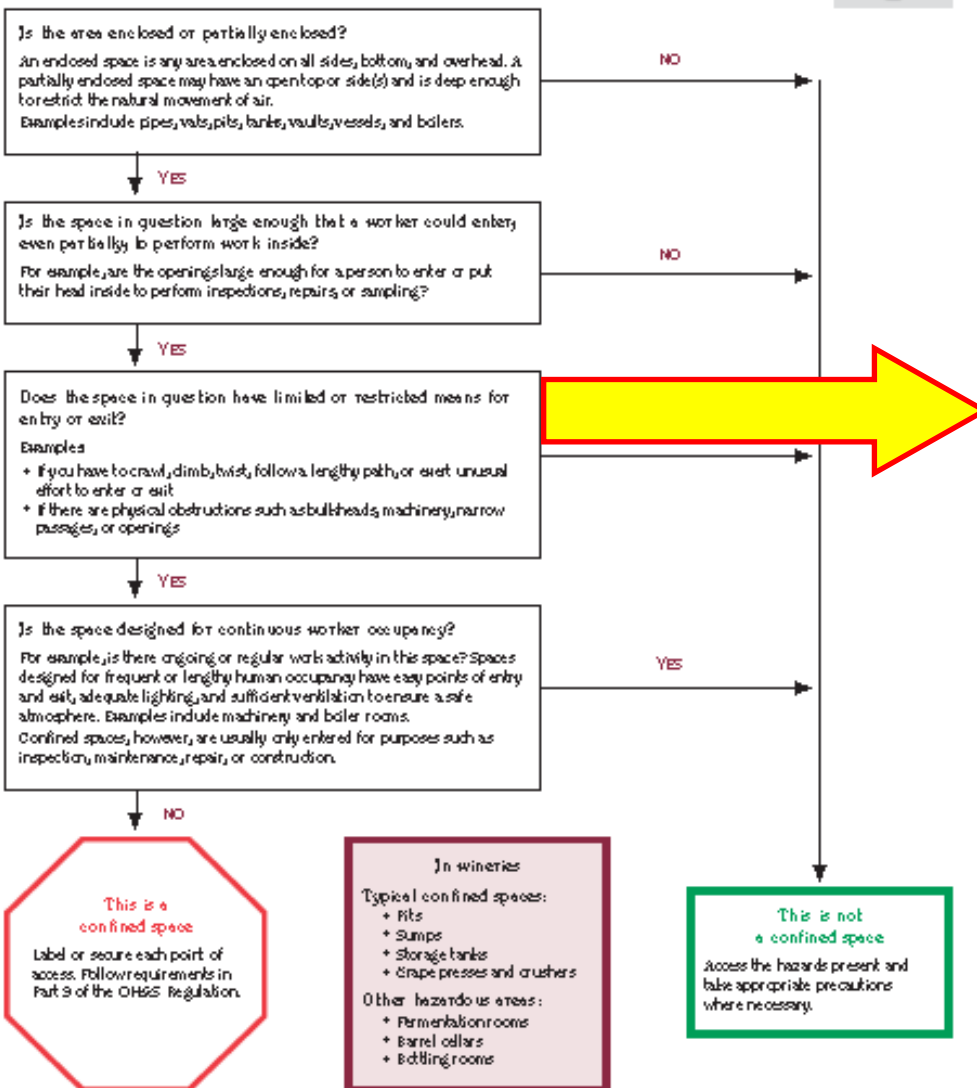
for continuous human occupancy. ③ It has limited or restricted means of entry or exit that may preclude first-aid provision, evacuation, rescue, or other emergency response service. ④ It is large enough and configured in such a way to enable a worker to perform assigned work.*

WorkSafe Magazine
Jan/Feb 2010



*The confined spaces shown in the above graphic are merely a representation of confined spaces and do not purport to represent all possible confined spaces present on all work sites.

What is a confined space?



G9.1-2 Definitions

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.







Does this space
meet all 4
confined space
definition criteria?



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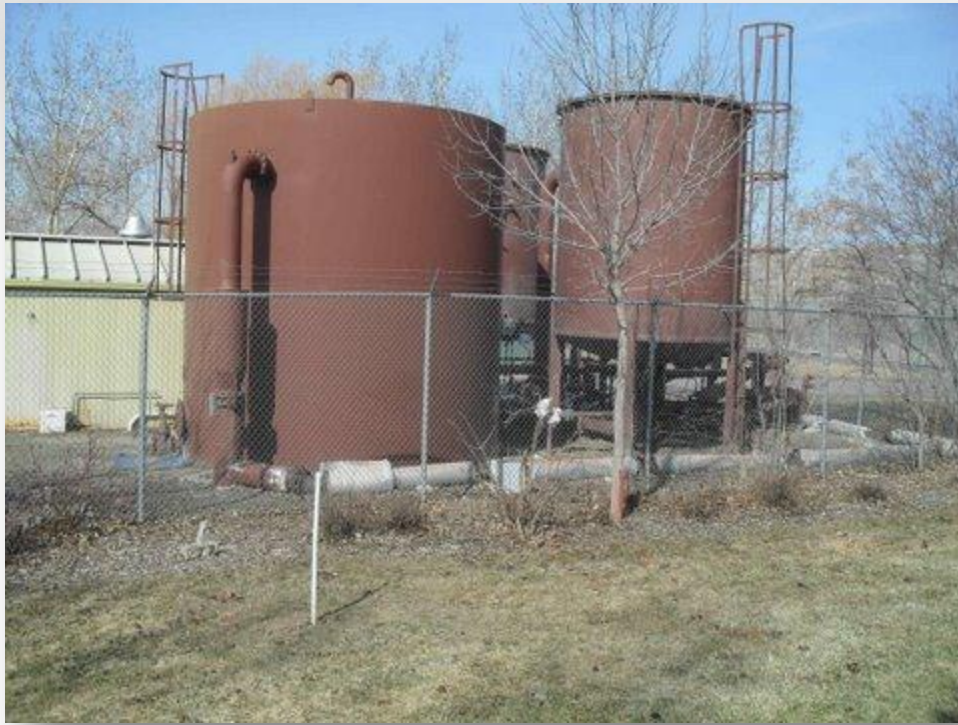


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“Excluded” spaces...

The following are spaces that the Board has determined to not be confined spaces for the purposes of Part 9 of the OHS Regulation:

- Swimming pools;
- Crawl spaces under school portables or other non-industrial buildings, with openings to atmosphere allowing for continuous passive ventilation;
- Trenches;
- Attic spaces with openings to atmosphere allowing for continuous passive ventilation;
- Open, unconnected manholes for storm or sewer hook-ups at new construction sites;
- Elevator shafts;
- HVAC plenums and related ventilation ductwork; and
- Underwater space during occupational diving operations

Refer to limitations in OHSR Guideline G9.1-1

How do I prepare for entry?

Confined space entry program

- a) an assignment of responsibilities,
- b) a list of each confined space or group of similar spaces and a hazard assessment of those spaces, and
- c) written safe work procedures for entry into and work in the confined space

Assign overall responsibility for administration of the confined space entry program to a person or persons adequately trained to do so.

Implementation

Supervision

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.

Instruction

Each person who is assigned duties or responsibilities related to entry into a confined space must be adequately instructed and trained in:

- a) the hazards of the space, and
- b) the precautions identified in written procedures to properly perform their duties.

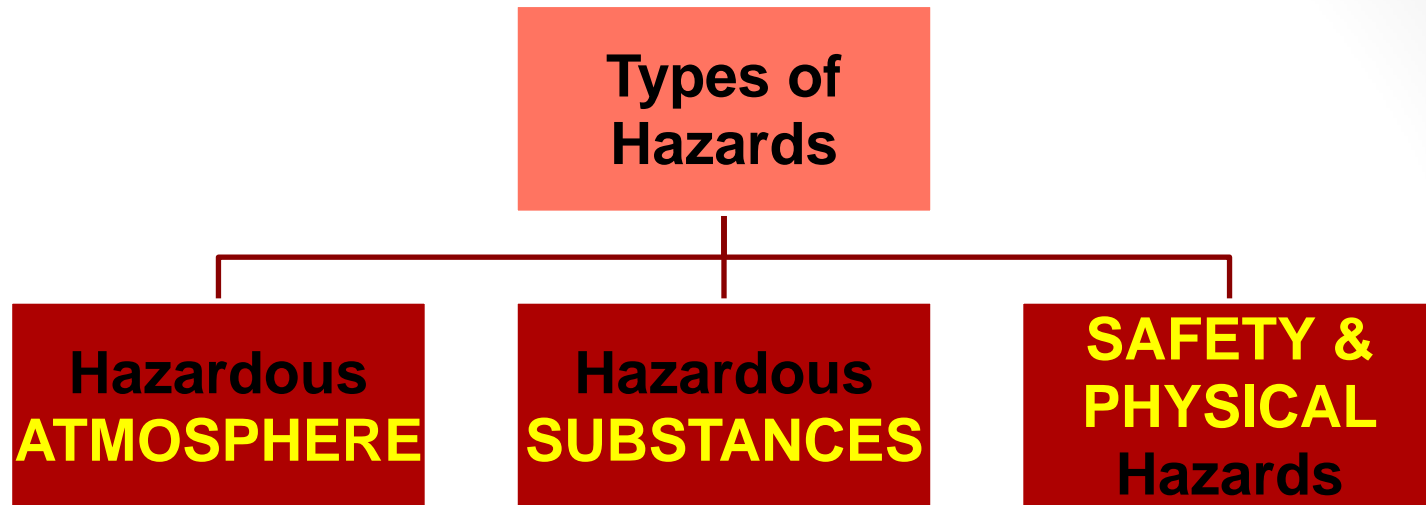
Hazard assessment

Hazard assessment and written entry procedures

- *Prepared by a Qualified Person (OHSR 9.9 to 9.11)*
-

9.9 Hazard Assessment

- (1) A hazard assessment must be conducted for each
 - (a) confined space, or each group of confined spaces which share similar characteristics, and
 - (b) work activity, or group of work activities which present similar hazards, to be performed inside a confined space.
- (2) The hazard assessment required by subsection (1) must consider
 - (a) the conditions which may exist prior to entry due to the confined space's design, location or use, or which may develop during work activity inside the space, and
 - (b) the potential for oxygen enrichment and deficiency, flammable gas, vapour or mist, combustible dust, other hazardous atmospheres, harmful substances requiring lockout and isolation, engulfment and entrapment, and other hazardous conditions.



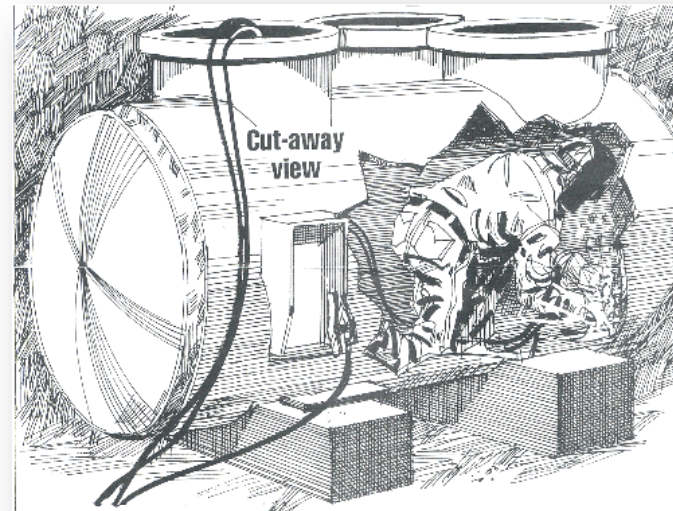
Must always consider
Space hazards (*design/location/use*)
Task/work activity hazards

Hazardous atmospheres



Three (3) considerations

1. Oxygen
2. Flammable or combustible atmospheres
3. Toxic atmospheres



Clean respirable air (CRA)

Equivalent to clean, outdoor air and which contains:

Oxygen approx. 20.9% vol

Lower explosive limit (LEL) = 0%

No **air contaminant** > 10% of its
exposure limit

Oxygen content

Oxygen Deficient (<19.5% oxygen by volume)

- Displacement by other gases;
- Chemical reactions such as rusting of metal;
- Combustion of flammable substances such as in welding and other hot work;
- Explosions or fires (oxygen levels may stay dangerously low long after the fire is out because the oxygen is replaced by the products of combustion);
- People working in the space and using up oxygen as they breathe.

Oxygen Enrichment (>23% oxygen by volume)

What happens when the level of oxygen is high?

- This will cause flammable materials, such as clothing and hair, to burn violently when ignited.

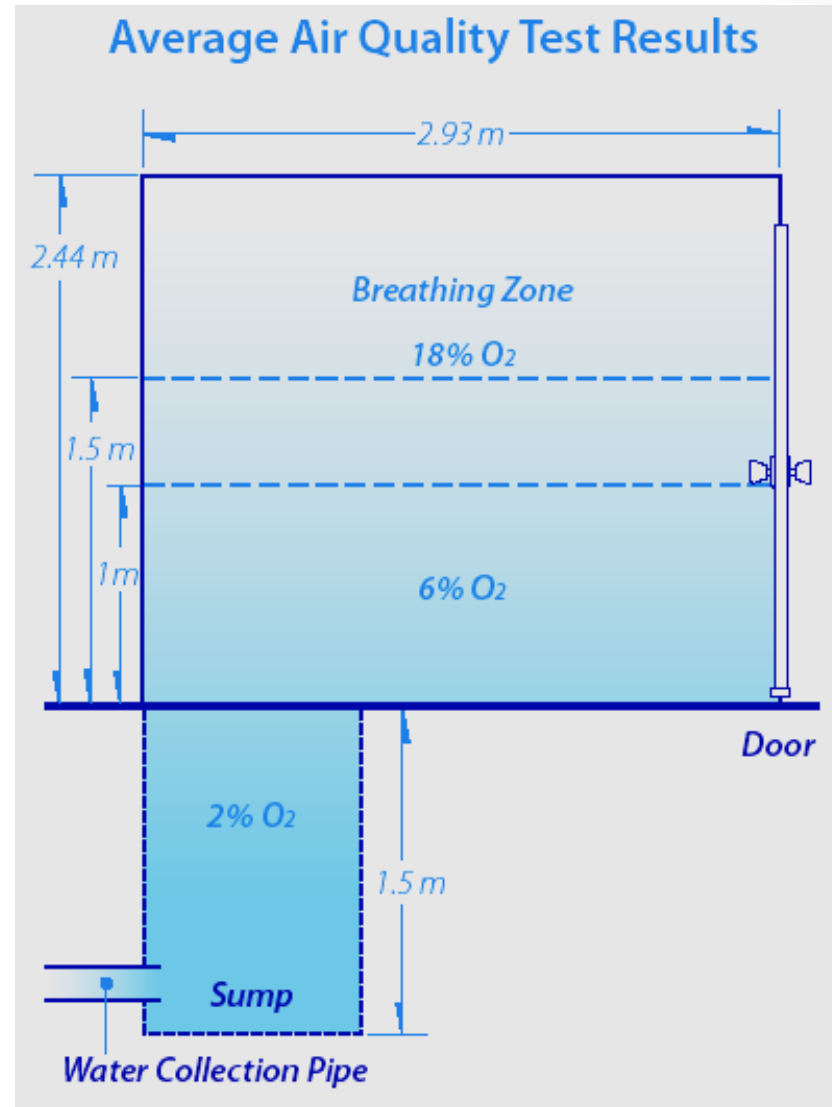
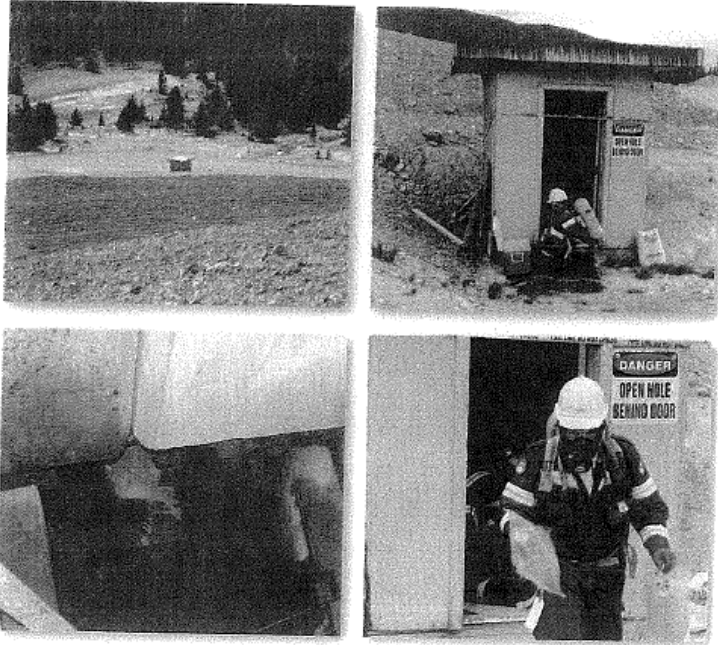
Never use pure oxygen to ventilate a confined space, since an oxygen-enriched atmosphere is a fire and explosion hazard.

Low oxygen conditions

- U.S. Chemical Safety Board Investigations
 - “Hazards of Nitrogen Asphyxiation” www.cbs.gov
Every year people are killed by breathing “air” that contains too little oxygen. Because 78 percent of the air we breathe is nitrogen gas, many people assume that nitrogen is not harmful. However, nitrogen is safe to breathe only when mixed with the appropriate amount of oxygen. These two gases cannot be detected by the sense of smell. A nitrogen enriched environment, which depletes oxygen, can be detected only with special instruments. If the concentration of nitrogen is too high (and oxygen too low), the body becomes oxygen deprived and asphyxiation occurs.



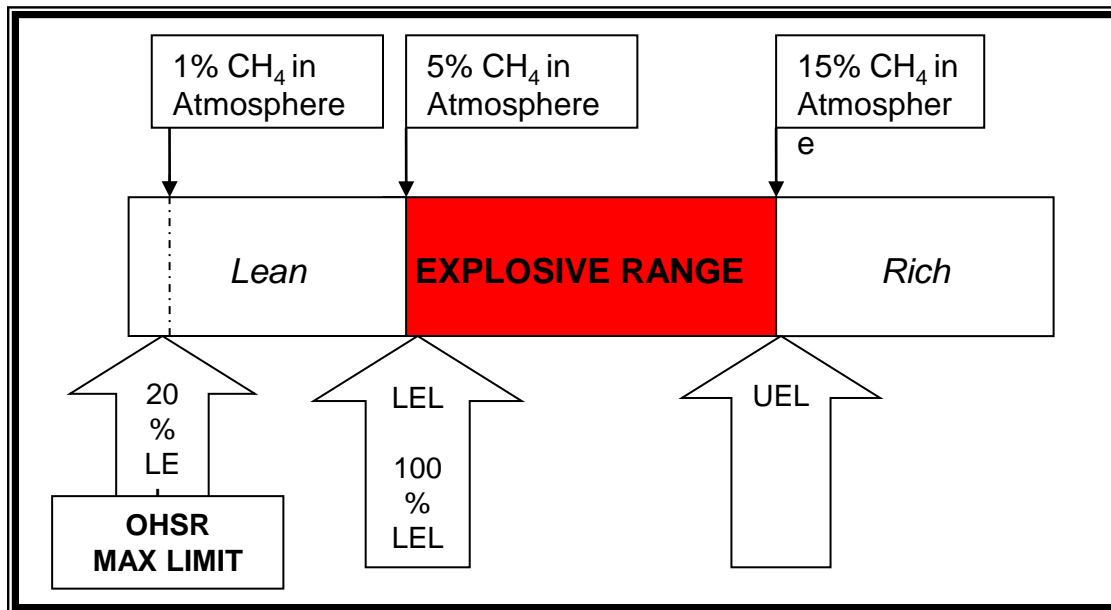
Sullivan Mine incident (May 2006)



Lower explosive limit (LEL)

Explosive limits (also known as “flammable limits”), expressed in percentage (%LEL), may be defined as the:

- minimum (LEL - lower explosive limit) and
- maximum (UEL – upper explosive limit)



Methane

LEL = 5%

UEL = 15%

OHSR hazardous atmospheres

LOW

- Contains 'clean respirable air'
- Not likely to change during the entry
- As determined by a qualified person

MODERATE

- Not 'clean respirable air'
- Worker could escape unaided if ventilation or respirator fails

HIGH

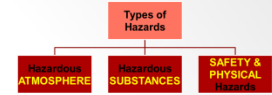
- Not 'clean respirable air'
- If ventilation or respirator fails:
 - Exposed to risk of death, incapacitation, injury or acute illness
 - Couldn't escape unaided

Hazardous substances



- Chemical hazards (non-atmospheric)
 - Skin
 - Ingestion
- Biological hazards: living organisms such as fungi, moulds, bacteria, viruses.

Safety and physical hazards



- Burns
- Electrical shock
- Falling objects
- Falls
- Inadequate working space
- Low visibility
- Fire hazards
- Material collapse
- Mechanical (moving parts)
- Noise
- Obstacles
- Poor access & egress
- Slippery conditions
- Static electricity
- Stored energy

Engulfment
Entrapment

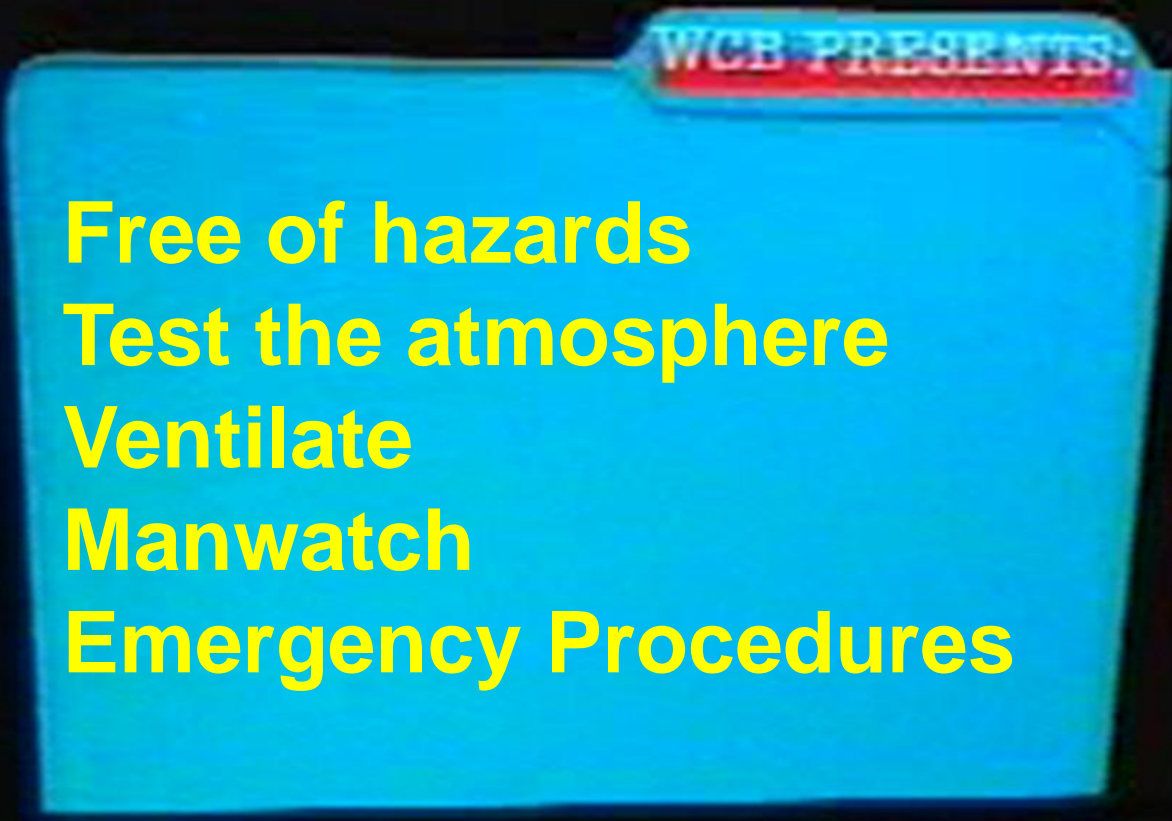
What are required entry practices?

Entry procedures

OHSR Section 9.10 Procedures

- Written procedures specifying the means to eliminate or minimize all hazards likely to prevail must be developed, based on the hazard assessment required by Section 9.9.

Typical entry practices...



Free of hazards
Test the atmosphere
Ventilate
Manwatch
Emergency Procedures

Entry procedures...

- (1) Identification and entry permits
- (2) Lockout and isolation
- (3) **Verification and testing (“test the atmosphere”)**
- (4) Cleaning, purging, venting or inerting
- (5) **Ventilation**
- (6) **Standby persons (“manwatch”)**
- (7) **Rescue (“emergency procedures”)**
- (8) Lifelines, harnesses, and lifting equipment
- (9) Protective equipment
- (10) Coordination of work activities

*Items in **RED** are the “flashes”*

Entry procedures...

Written safe work procedures for entry into must address:

- (1) Identification and entry permits
- (2) Lockout and isolation
- (3) Verification and testing
- (4) Cleaning, purging, venting or inerting
- (5) Ventilation
- (6) Standby persons
- (7) Rescue
- (8) Lifelines, harnesses, and lifting equipment
- (9) Protective equipment
- (10) Coordination of work activities

Lockout and isolation

Before a worker enters a confined space, any material conveyance equipment that transports material **to** or **from** the space must be free of material if the material could present a hazard.

- Control of harmful substance in adjacent piping
- Alternative measures of control or isolation of adjacent piping

(Refer to OHSR Part 9 Guidelines)

Entry procedures...

Written safe work procedures for entry into must address:

- (1) Identification and entry permits
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- (3) Verification and testing**
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- (5) Ventilation
- (6) Standby persons
- (7) Rescue
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- (9) Protective equipment
- (10) Coordination of work activities

Verification and testing

- 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.
- When practicable, the employer must ensure that a confined space to be entered contains clean respirable air.

Testing

- May not only be atmospheric
- Atmospheric testing based on hazard assessment
- Equipment maintenance and checks
 1. Calibration (regular)
 2. Daily functional (bump) test
 3. Fresh air zero"
- Appropriate and proper testing practices
- Recordkeeping



Gas testing



Typical Sensors

- Oxygen
- Flammable (LEL)
- Carbon monoxide
- Hydrogen sulphide

Others

- Carbon dioxide
- Photo-ionization



What don't they tell us...



WORKSAFE BULLETIN

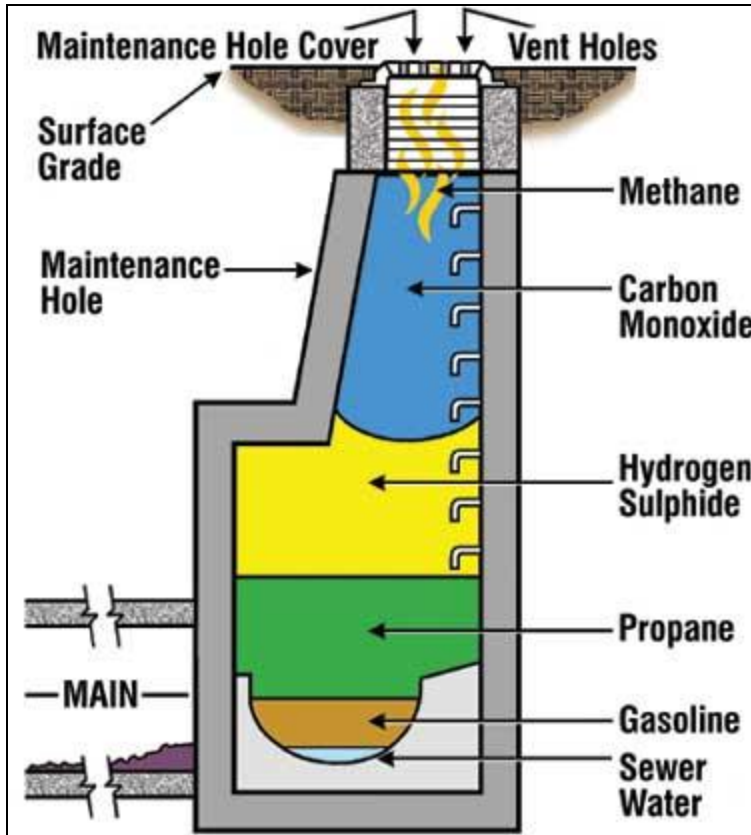


Incorrect use of monitoring equipment in confined spaces can endanger workers

Several workers in a vault below a bridge could have been poisoned by carbon monoxide (CO) from gas-powered tools they were using in the confined space. The air monitoring equipment being used to check for toxic gases could not sound an alarm if CO reached dangerous levels because there was no CO sensor in the instrument.

- Appropriate sensor for gas/condition to be detected has to be present
- Oxygen sensor is not a “catch all”!

Gas density



- Pre-entry testing
- Continuous or intermittent testing
- Test all areas of a confined space
- “Passive/direct” and/or “remote”
 - Use of manual or automatic pumps

New Westminster barge (Jan 10 2003)

WCB-BC Dec 9, 2003 Accident Investigation Report

2003010004 Westminster Marine Services Limited / City of New Westminster

Void Space Air Testing – 2003 January 13

Number 1 Starboard Void Space (cover opened 0843 hours, test initiated 08:46 hours)

#	Test Nozzle Location	O ₂ Reading	CO Reading	LEL Reading	H ₂ S Reading
1.	At flange face	20.5%	0	0	-
2.	5 feet below flange face	17.0%	0	0	-
3.	10 feet below flange face	17.0%	0	0	-
4.	15 feet below flange face	17.0%	0	0	-
5.	20 feet below flange face	17.1%	0	0	-
6.	22 feet below flange face	17.1%	0	0	-
7.	20 feet below flange face (ascending)	17.2%	0	0	-

Instrument Used: Industrial Scientific CMX 271, Bar Code Number 5098

EHS Today (2005)

“COMMON MISTAKES IN CONFINED SPACE MONITORING”

- 1) Not knowing [OSHA] standards and requirements
- 2) Using your own senses
- 3) Disregarding the importance of training
- 4) Not implementing a gas monitoring maintenance program
- 5) Not knowing which toxic gases may be present
- 6) Not performing a pre-entry test
- 7) Considering the confined space after pre-entry testing
- 8) Not assigning an attendant
- 9) Not having an emergency plan

Entry procedures...

Written safe work procedures for entry into must address:

- (1) Identification and entry permits
- (2) Lockout and isolation
- (3) Verification and testing
- (4) Cleaning, purging, venting or inerting
- (5) Ventilation**
- (6) Standby persons
- (7) Rescue
- (8) Lifelines, harnesses, and lifting equipment
- (9) Protective equipment
- (10) Coordination of work activities

Ventilation requirements

Every confined space must be ventilated continuously while a worker is inside the space, except in

- a) an atmosphere intentionally inerted in accordance with section 9.29,
- b) a low hazard atmosphere controlled in accordance with section 9.31(2), or
- c) an emergency rescue, if ventilation is not practicable.

Ventilation equipment

Types

- Permanent
- Portable

Methods

- Positive pressures
- Negative pressure
- Local exhaust (work tasks)
- Combinations



Entry procedures...

Written safe work procedures for entry into must address:

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- (4) Cleaning, purging, venting or inerting
- (5) Ventilation
- (6) Standby persons**
- (7) Emergency procedures**
- (8) Lifelines, harnesses, and lifting equipment
- (9) Protective equipment
- (10) Coordination of work activities

Emergency procedures



Emergency procedures



- Contacts and Incident Command
- Protocols and responses understood
- Type of emergency
 - Self-removal
 - Non-entry
 - Entry
- External providers

Emergency training

- Every person assigned rescue duties must be properly equipped and adequately trained to carry out such duties.
- A practice drill must be conducted at least annually.
- Records of training and practice drills must be maintained by the employer of the rescue persons.



TOP STORY

BORDER RESCUE

Entry procedures...

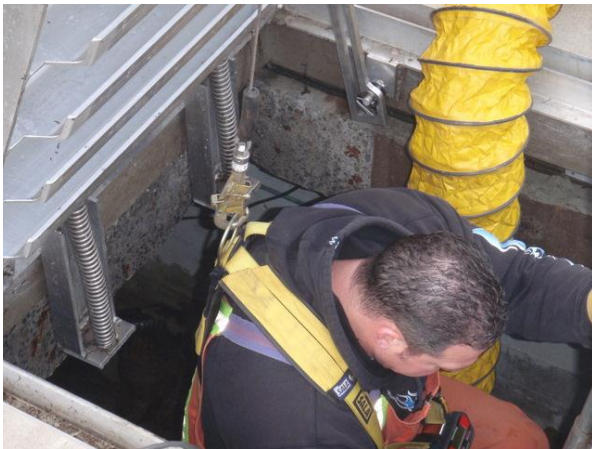
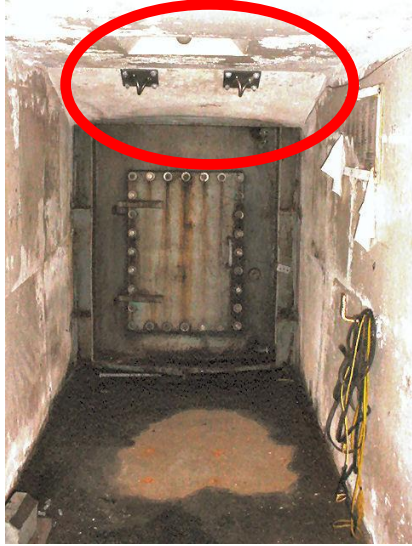
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- (10) Coordination of work activities

Lifelines, harness, lifting eqpt...



Emergency equipment



Entry procedures...

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- (10) Coordination of work activities

What else is there to consider?

Education and training

Each person who is assigned duties or responsibilities related to entry into a confined space must be adequately instructed and trained in:

- a) the hazards of the space, and
- b) the precautions identified in written procedures to properly perform their duties.

Confined space program administrator

Entry (responsible) supervisor

Entrants

Standby person

Emergency responders

Make life easier!



BEFORE



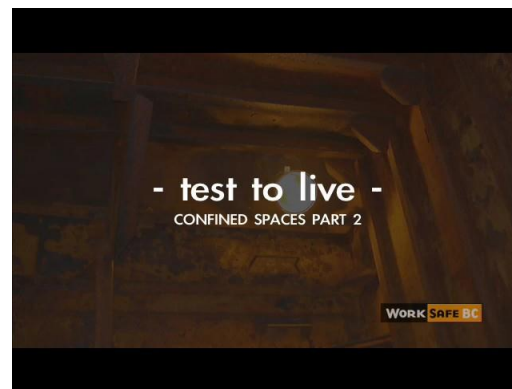
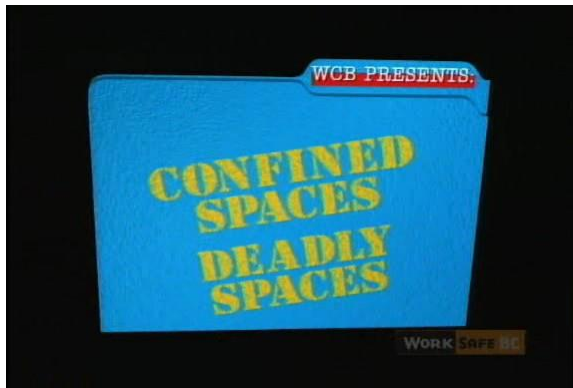
AFTER



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Resource materials

- WorkSafeBC “Safety at Work” Confined Space webpages
- WorkSafeBC “Confined Space Entry Program: A Reference Manual BK84” [April 2007]



Canadian Standards Association Z1006

NEW!!!
May 2010



SALUS

Summing up

- Identify confined spaces
- Implement a Confined Space Program
- Prepare for entry
 - Hazard assessment AND entry procedures
- Instruction (education and training)
- Proper implementation
 - “5 flashes”
- Plan and prepare for the emergency
- Review activities regularly

Questions?

Thank you.

For more information please contact:

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