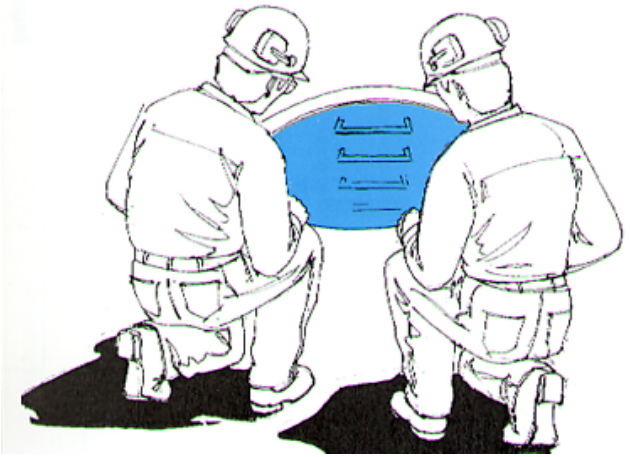
Prevention Division

Confined Space Entry Workshop



WorkSafe™

WORKERS' COMPENSATION BOARD OF BRITISH COLUMBIA

Introduction

- What are hazards of confined space entry?
- Why test?
- What should we test for?
- Why new requirements?

Confined Spaces-Fatal Mistakes

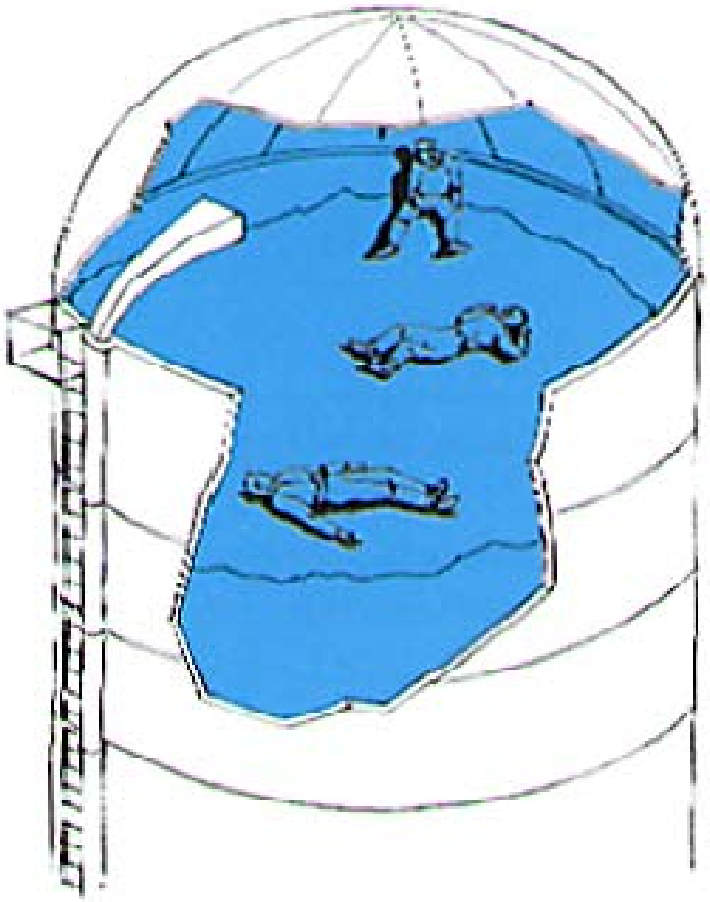
- Entering a space without testing
- Assuming space OK based on past experience
- using oxygen to ventilate a space
- not checking welding hoses for leaks

Confined Spaces-Fatal Mistakes

- not ventilating
- not planning for rescue
- not considering effects of disturbing contents
- welding w/o checking adjacent compartments
- not considering nearby activities/operations

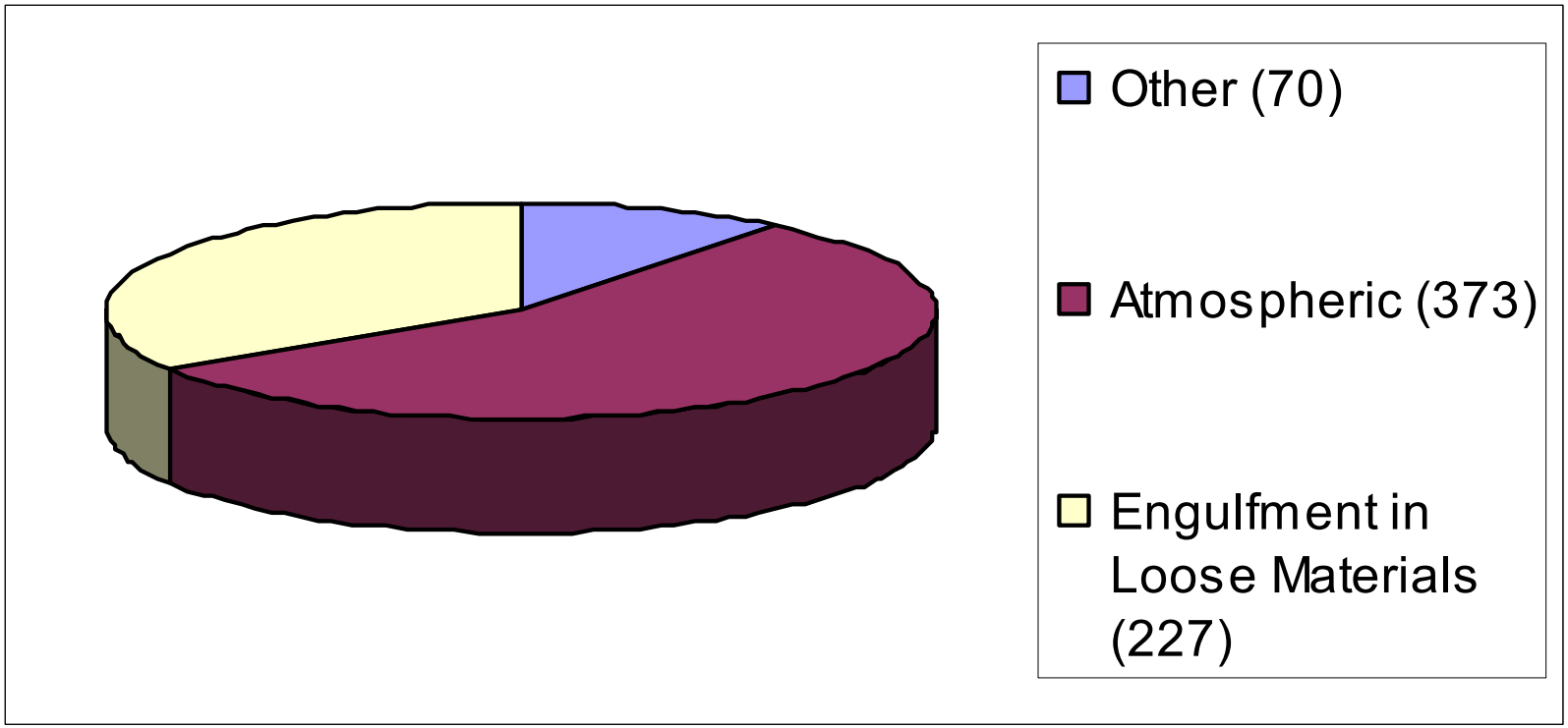
Confined Space Fatalities: BC's Experience 1985-1997

- Hydrogen Sulfide----2
- Flammable/explosive atmosphere----1
- Oxygen deficiency----6



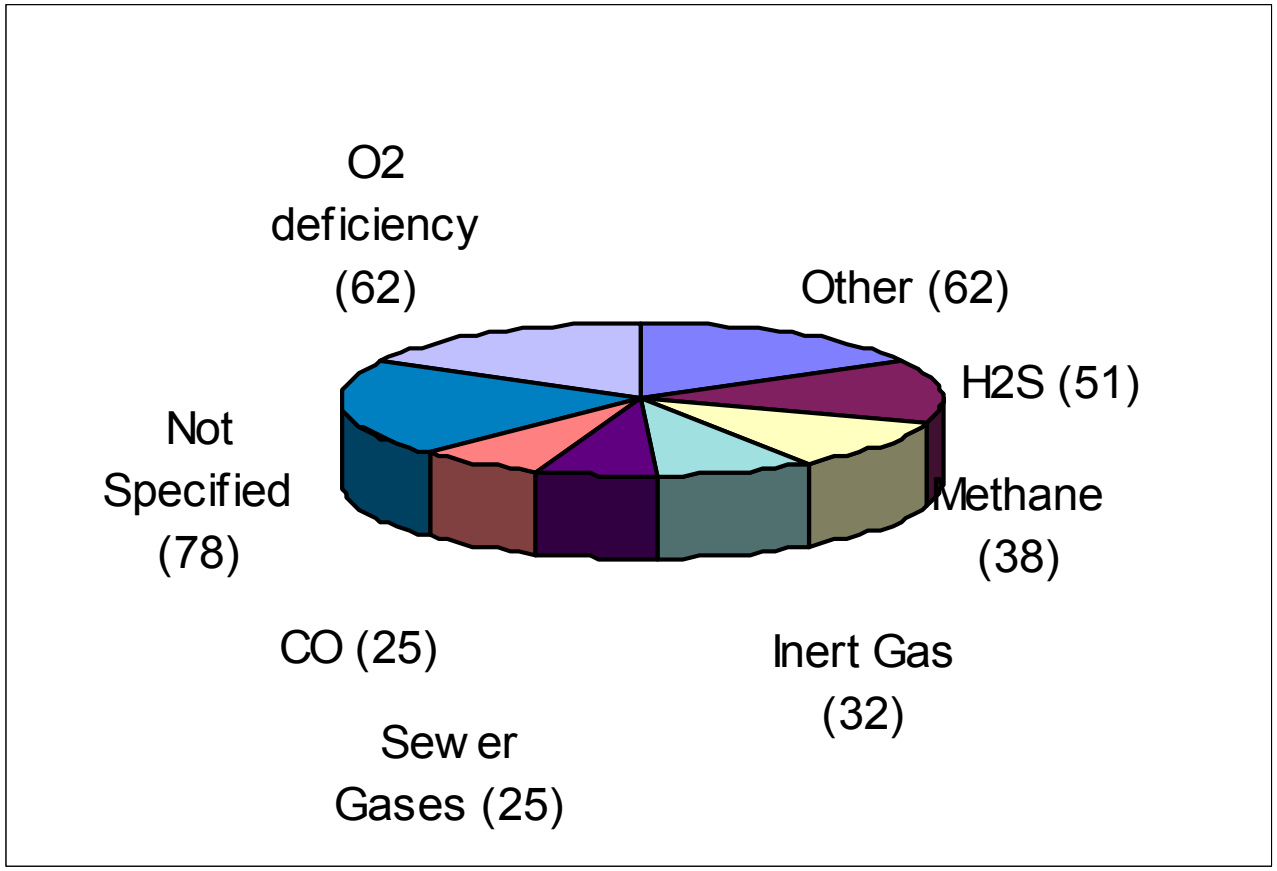
NIOSH Data (1980-1989)

Cause of deaths in Confined Spaces (n=670)

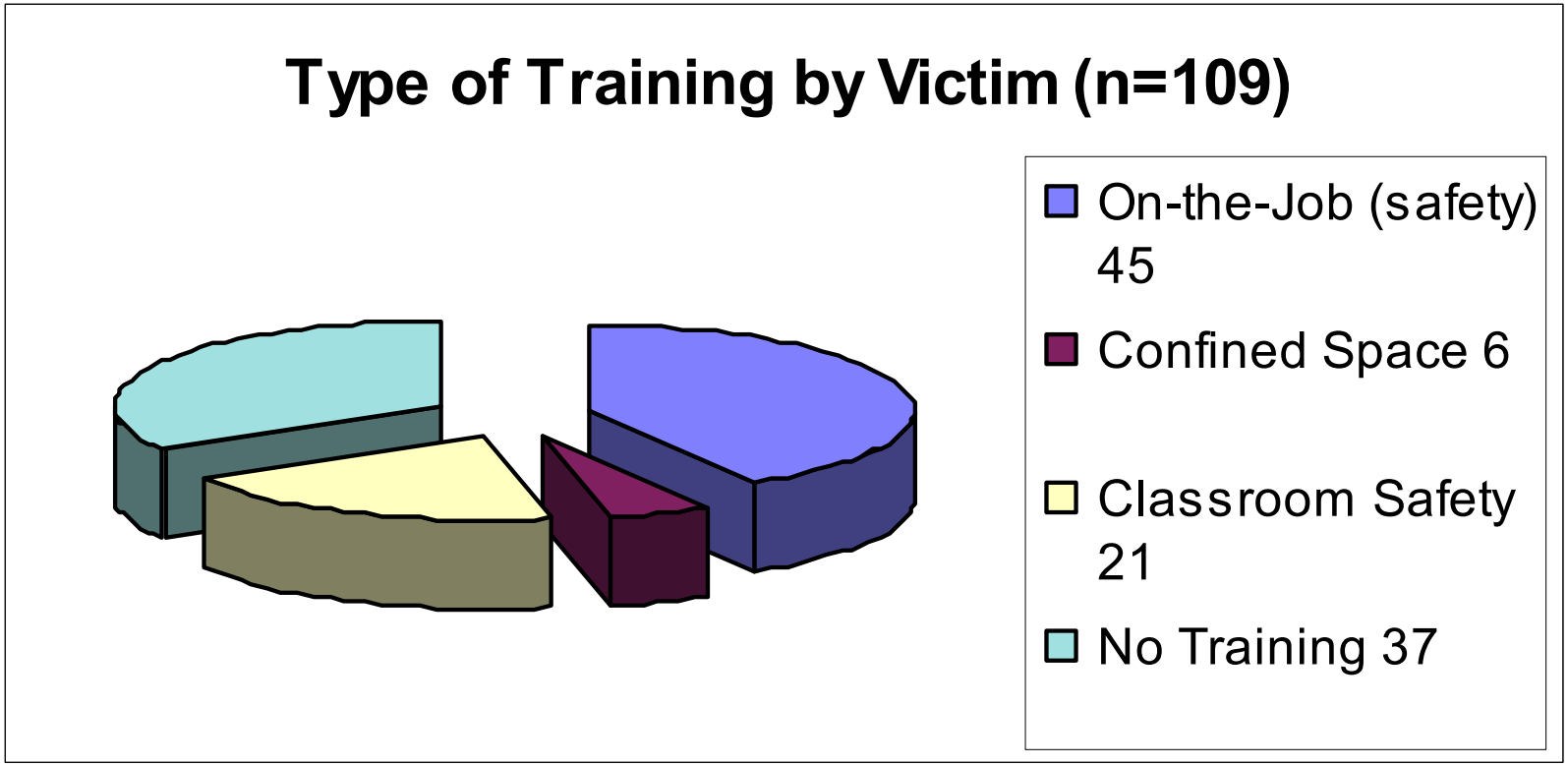


NIOSH Data (1980-1989)

Atmospheric: Confined space deaths : (n=373)



NIOSH Study (1983-1993)



Confined Space Fatalities: NIOSH Study 1983-89

- **Industries**
  - 24% municipal services (88 events)
- **Cause of death**
  - 47% asphyxiation, 21% drowning, 19% toxics
- **Type of activity**
  - 48% cleaning, repairing, inspection, 39% rescue

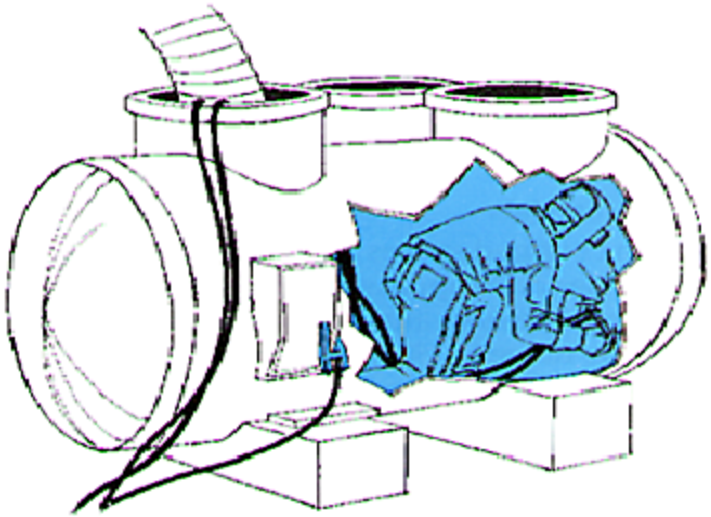
Confined Space Fatalities
NIOSH Study 1983-89

- **Fatality factors**
  - authorized to enter 89%
  - prior entry of space 80%
  - entry procedures 27%
  - rescue procedures 11%
  - rescue equipment 4%
  - worker training 5%
  - space ventilated 4%
  - atmospheric testing ?

Part 9: Confined Spaces

What's New ?

The impact of the new regulations



Overview

New Definitions

More detailed than old regulations

12 Sections in New Regulations

8 in existing Regulations

Overview

- **New requirements:**
  - **Written program**
  - **Procedures prepared by Qualified person**
  - **Hazard Assessment must be conducted**
  - **Entry Permit required under certain circumstances**
  - **Outside air quality required where possible**
  - **Annual Rescue practice Drills**

Overview

- **New allowances:**

  LOW hazard conditions

  - pre-entry testing not always required

  - continuous ventilation not always required

  - person-check system allowed

Overview of 12 Sections

1 General Requirements

2 Responsibilities

3 Hazard Assessment & Work Procedures

4 Identification & Entry Permits

5 Lockout and Isolation

6 Verification and Testing

Overview of 12 Sections

7 Cleaning, Purging, Venting, Inerting

8 Ventilation

9 Standby Persons

10 Rescue

11 Lifelines, Harnesses and Lifting Equipment

12 Personal Protective Equipment and Other Precautions

Definitions - Confined Space
Labour Canada

- **Enclosed or partially enclosed space that**
  - **is not designed or intended for human occupancy except for the purpose of performing work.**
  - **Has restricted means of access and egress and**
  - **may become hazardous to any person entering it owing to**
    - **its design, construction, location or atmosphere**
    - **the materials or substances in it or**
    - **any other conditions relating to it**

Definitions - Confined Space
ANSI

- An enclosed area that is large enough and so configured that an employee can bodily enter and has the following characteristics:
  - its primary function is something other than human occupancy
  - has restricted entry and exit
  - may contain potential or known hazards

Definitions - Confined Space
OSHA

- (1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

- (2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

- (3) Is not designed for continuous employee occupancy.

Definitions - Confined Space
WCB OH&S Regulation

- Enclosed or Partially Enclosed but not an underground working
- Not designed or intended for <u>continuous</u> occupancy
- Restricts access for evacuation or rescue
- Large enough that workers can enter tom perform work

Example 1

- A 20 foot high, cylindrical, stainless steel brew tank with a 18 by 24 inch hatch?

YES

- Similar spaces may include silos, tanks, storage bins or hoppers, vats, digesters, boilers or other process vessels.

Example 2

- **A 100 foot long tunnel under construction?**

NO

- **Underground workings includes: any adit, tunnel, underground excavation, chamber, caisson, raise, shaft, winze or natural entry (part 22).**

Example 3

- **A completed bulk excavation, 50 by 100 feet wide, 8 feet deep…access by a ramp or slope at one end?**

NO

- **Given large dimensions, not sufficiently enclosed**

Example 4

- **An underground vault with door and stair access, and an exhaust system meeting ASHRAE standards?**

NO

- **Designed for continuous occupancy**

Example 5

- **A clean, supply air, ventilation duct 6 by 4 feet wide by 20 feet long with an inspection entry hatch 4.5 by 3 feet, access from stairs and landing?**

NO?…YES?

- **Means of entry may, or may not be restricted (i.e. does, does not meet criteria (c) for confined space definition).**

Example 6

- **A void space in an interior wall, 1 by 1 by 2 feet?**

NO

- **Not large enough that a worker could enter to perform assigned work.**

Other examples

Are the following confined spaces?

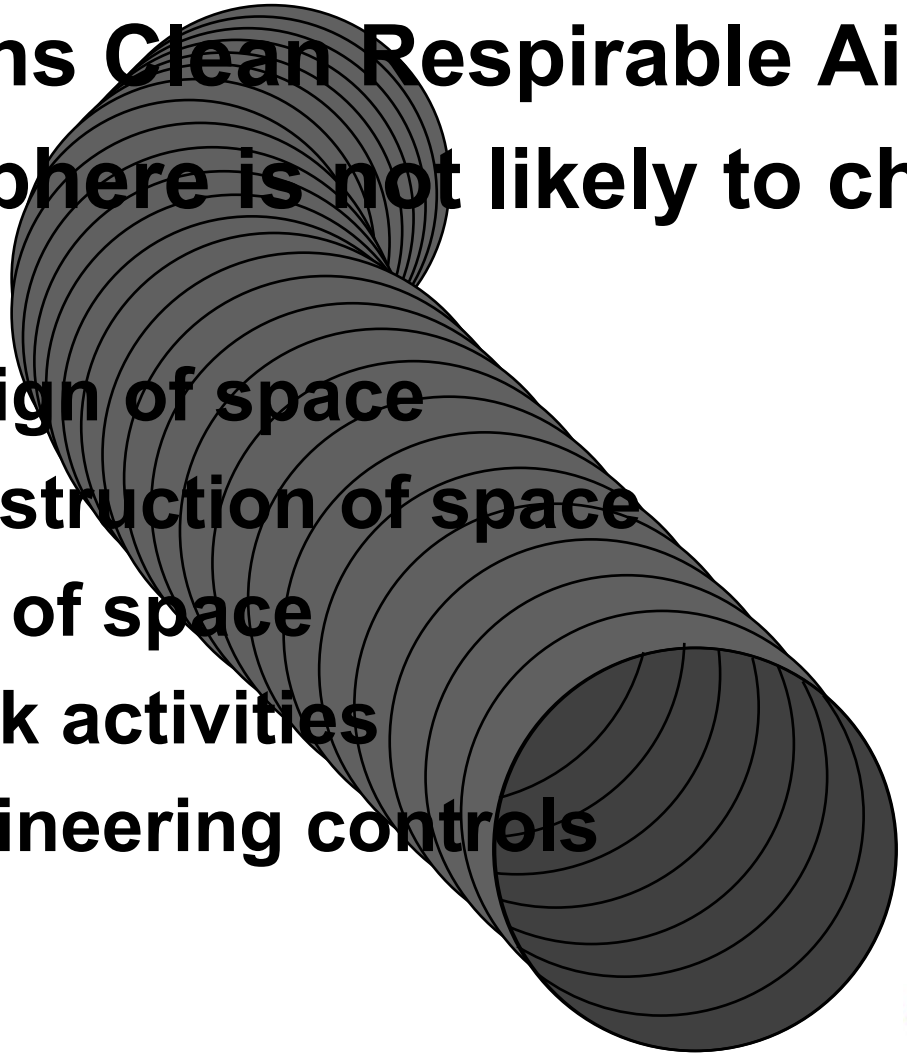
- **excavation in “native soil”**
- **excavation in contaminated soil (e.g. near landfill, underground storage tanks)**
- **wet well under construction**
- **crawl space or basement below building to install plumbing or gas lines**
- **attic/ceiling space above building ceilings for electrical work**
- **tank or vessel fabrication or repair**

Definitions:
Clean Respirable Air

- **Same as clean outdoor air**
  - **About 20.9 % Oxygen**
  - **No measurable flammable gas or vapour**
  - **Air contaminants less than 10 % of Exposure Limits (EL)**

Definitions:
Low Hazard Atmosphere

- Contains Clean Respirable Air
- Atmosphere is not likely to change due to:
  - Design of space
  - Construction of space
  - Use of space
  - Work activities
  - Engineering controls

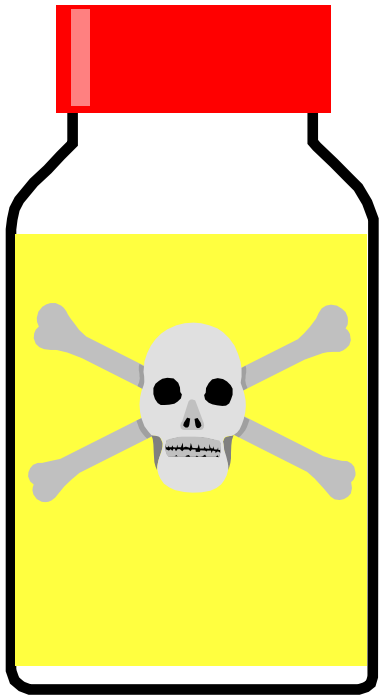


Definitions: Moderate Hazard Atmosphere

- **DOES NOT contain Clean Respirable Air**
- **Workers ability to escape unaided WILL NOT be effected if respirator or ventilation fails**

Definitions:
High Hazard Atmosphere

- DOES NOT contain Clean Respirable Air
- Workers WILL BE exposed to a risk of:
  - Death
  - Incapacitation
  - Injury
  - Acute illness or
  - Inability to escape unaided if respirator or ventilation fails



General Requirements

- **Confined spaces must be identified**
- **Determine if entry is required**
- **If no worker entry is required secure the space against entry or post sign**
- **Eliminate or minimize hazards before entry**
- *Develop* **and** *Implement* **a** *Written Program*

General Requirements

📖 Written Confined Space Program

- assigns responsibilities
- provides and inventory of confined space
- hazard assessment of each space
- written procedures

General Requirements

- **Written procedures must address**

  - identification & entry permits
  - lockout & isolation
  - verification & testing
  - cleaning, purging, venting or inerting
  - ventilation

General Requirements

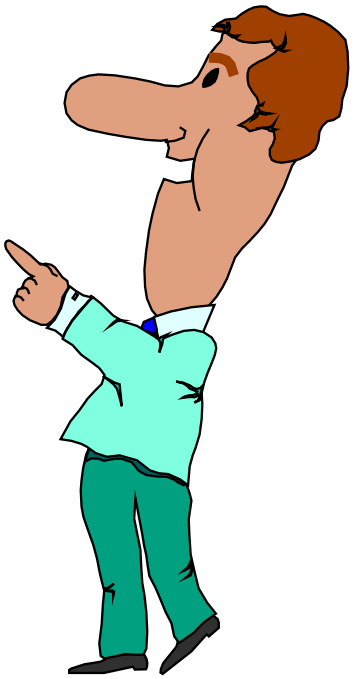
- Written procedures must address

  - standby persons
  - rescue
  - lifelines, harnesses & lifting equipment
  - personal protective equipment & other precautions
  - coordination of work activities

Responsibilities

Employer

- assigns program responsibility to an Administrator
- ensures Administrator is adequately trained
- assigns supervisory responsibilities



Responsibilities

Supervisor

- must be adequately trained to supervise confined space work
- must ensure
  - pre-entry testing & inspections are conducted according to the written procedures
  - specified precautions are followed
  - only authorized workers enter the space

Responsibilities

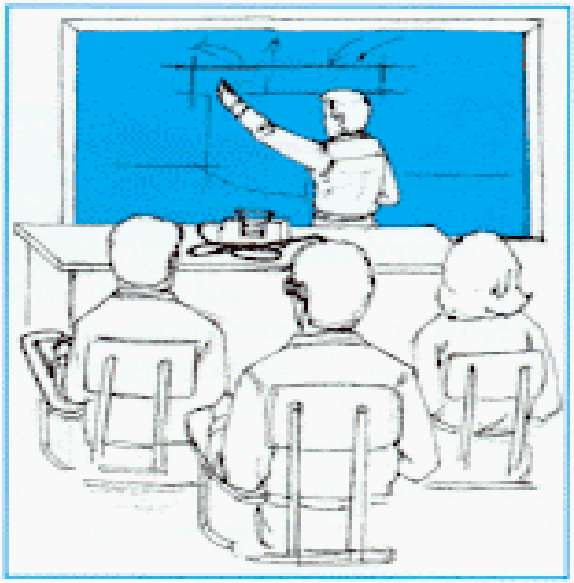
Worker

- must be instructed & trained in the:
  - hazards of the space
  - precautions for entry
- must be informed of any changes in Entry Permits

Qualifications of Instructors

Instructors should be able to apply techniques of adult instruction and must have a thorough working knowledge of:

- Types of confined spaces at the worksite
- Hazards likely to be encountered, both chemical and physical
- Work practices and techniques
- Testing requirements
- Safe limits for oxygen, flammable materials and other air contaminants
- Rescue procedures
- Health and Safety Regulations which apply
- Safety equipment (selection, care, use, maintenance)

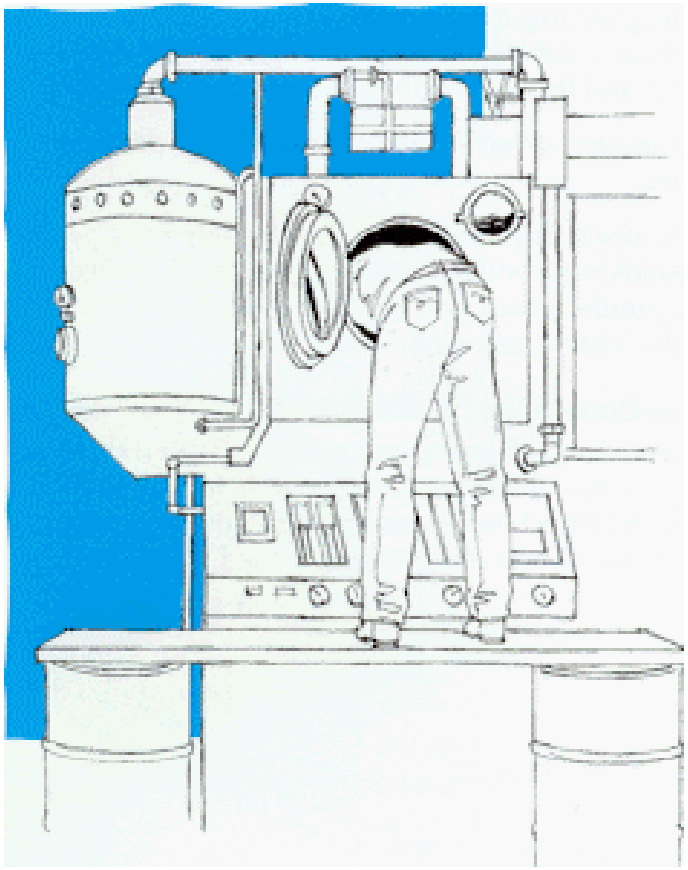


Selection of Trainees

Training must be provided to all workers involved with the confined space program, for example:

- Workers who prepare a confined space for entry
- Workers likely to enter confined spaces
- Testing personnel
- Standby workers
- Members of the rescue team
- Supervisors of any of the above

Hazard Assessment



Hazard Assessment & Work Procedures

Hazard Assessment required for each

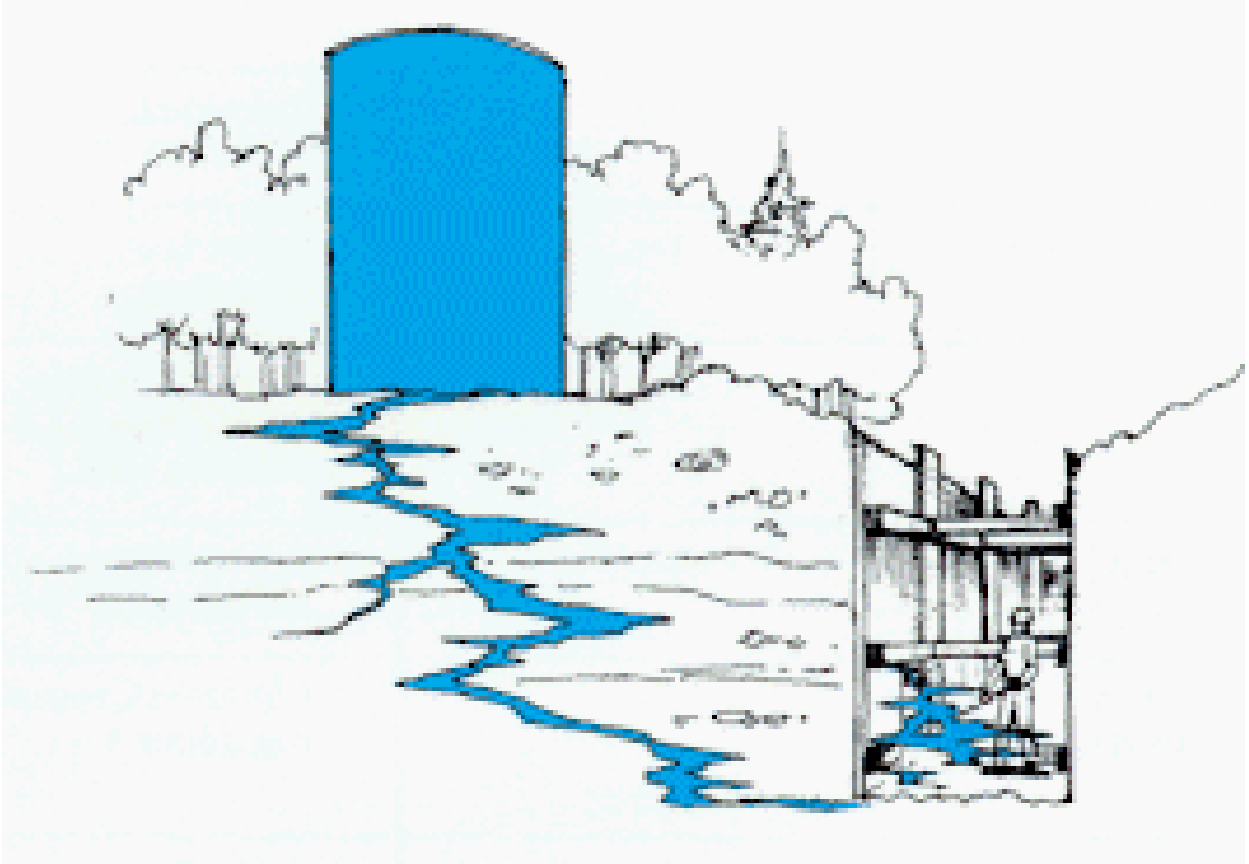
- space or group of similar spaces
- work activity or group of activities with similar hazards

Hazard Assessment & Work Procedures

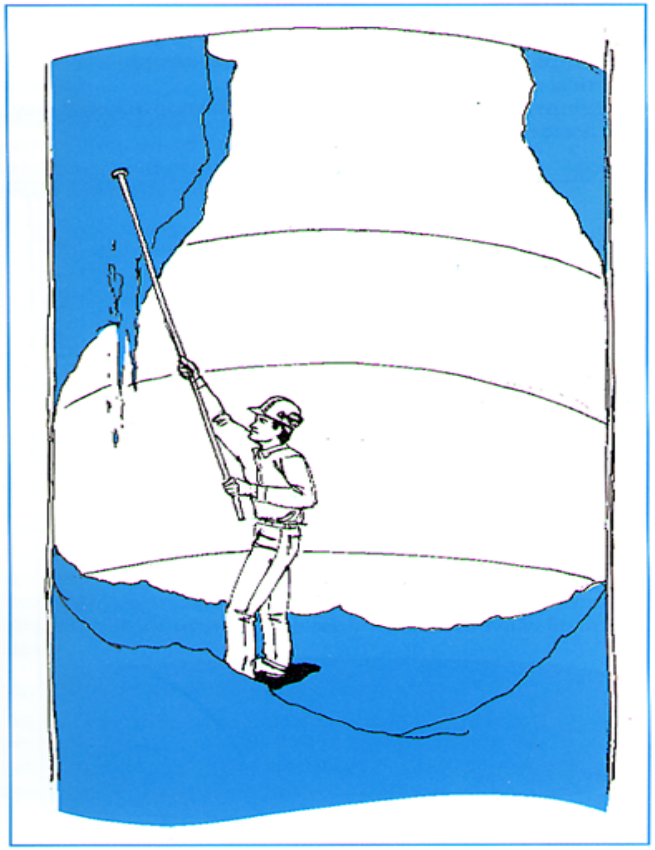
Hazard Assessment to consider :

- conditions that exist or may develop
- oxygen enrichment & deficiency
- flammable gases
- vapour or mist
- combustible dust
- other hazardous atmospheres
- substances requiring lockout & isolation
- engulfment & entrapment
- other hazardous conditions

Hazard Assessment & Work Procedures



Hazard Assessment & Work Procedures



Hazard Assessment & Work Procedures

- **Work Procedures specify how to eliminate or minimize the hazards**
- **Hazard Assessment & Procedures must be prepared by Qualified persons**

  - in consultation with program Administrator and

  - Health and Safety Committee or

  - Health and Safety representative, if any

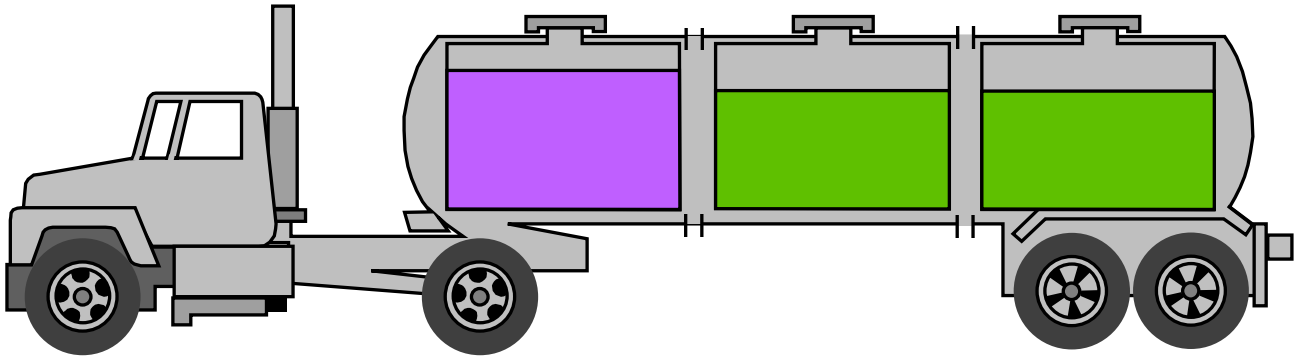
Hazard Assessment & Work Procedures

Qualified persons include:

- Certified Industrial Hygienists (CIH)
- Registered Occupational Hygienists (ROH)
- when experienced in occupational hygiene related to confined spaces
  - Certified Safety Professionals (CSP)
  - Canadian Registered Safety Professionals (CRSP)
  - Professional Engineers (PEng)
- persons with education, training and experience acceptable to the board

Identification & Entry Permits

- Post signs at unsecured entrances identifying hazards contained within the confined space



Identification & Entry Permits

Entry Permits

- are completed & signed by supervisor
- required for entry to
  * HIGH hazard atmospheres
  * Spaces requiring LOCKOUT or ISOLATION
  * Spaces with a risk of ENTRAPMENT or ENGULFMENT
- posted at the entrance to the space
- must be retained for one year

Identification & Entry Permits

Entry Permit contents:

- specifies the confined space and work activity
- identifies the workers in the space
- states the required precautions
- specifies when the permit expires

Identification & Entry Permits

Permits may only be altered to

*** update the list of workers in the space**

*** update the record of test results**

*** update the precautions due to a review of the work activities**

Permits are re-authorized & signed when

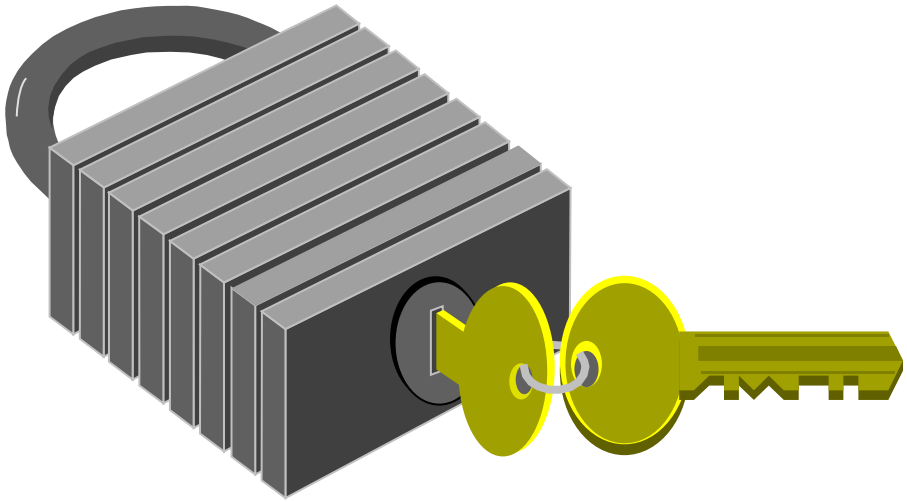
*** work crews change**

*** shifts change**

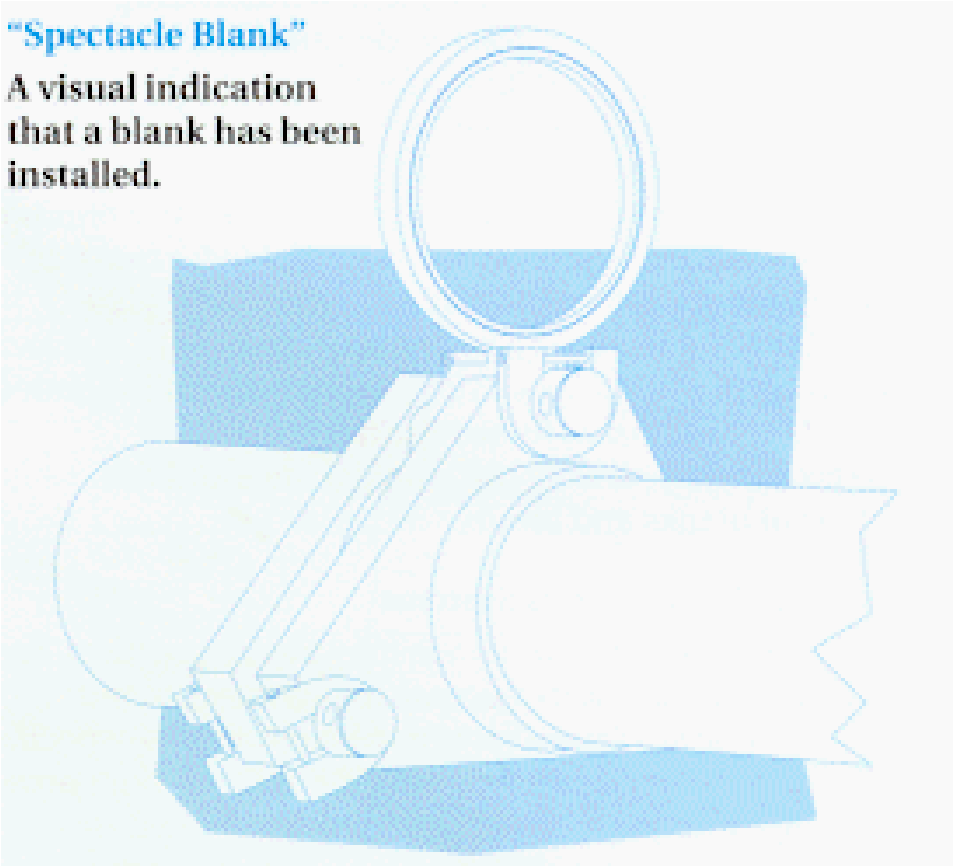
*** supervisors change**

Lockout

All hazardous energy sources must be locked out before entry



Isolation


"Spectacle Blank"
A visual indication that a blank has been installed.

Isolation

- required if adjacent piping contains, or has contained, a harmful substance
- closing a valve is not an acceptable means of isolation
- may be accomplished by:
  - disconnecting, blanking or blinding
  - double-block & bleed if not a gas, vapour or volatile liquid in adjacent piping

Isolation

- records must be kept which identify isolation point locations
- isolation points must be visually checked before entry

Isolation Exceptions

- **If a substance is harmful due to its pressure, temperature or quantity only and**

  - Pressure >15 psig: de-pressurize and lockout

  - Pressure <15 psig: other effective means

- **“p-trap” for isolation from sewer system**

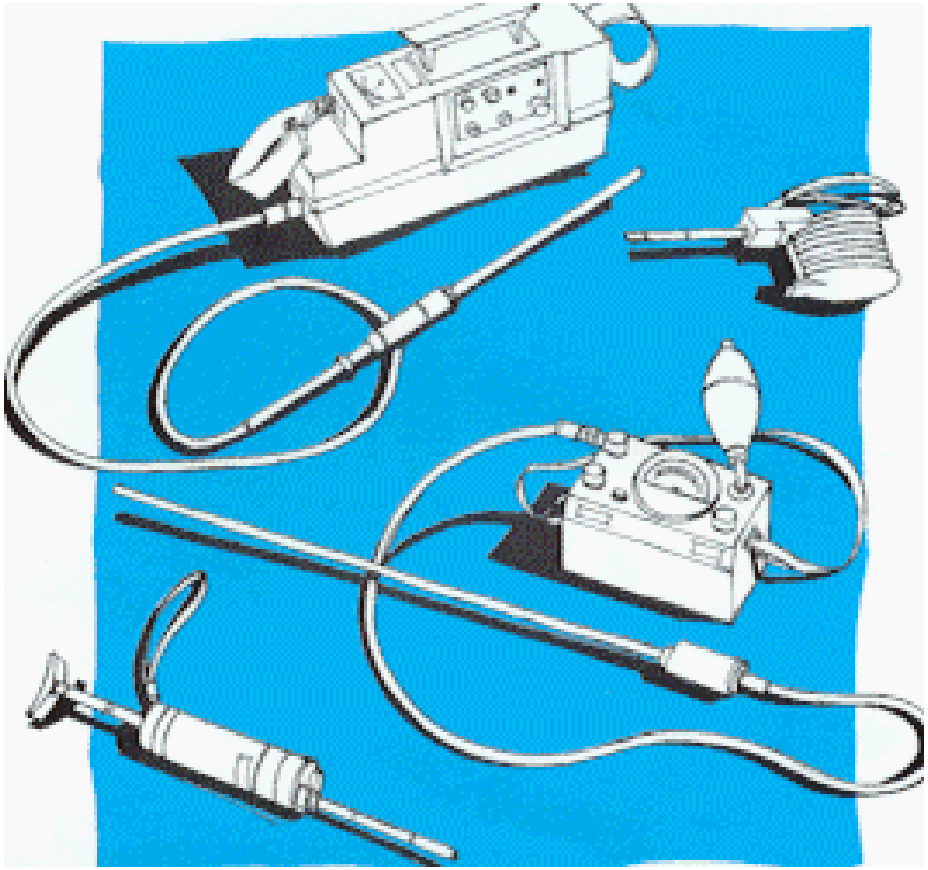
Verification

Pre-entry inspection required to verify identified hazards have been controlled

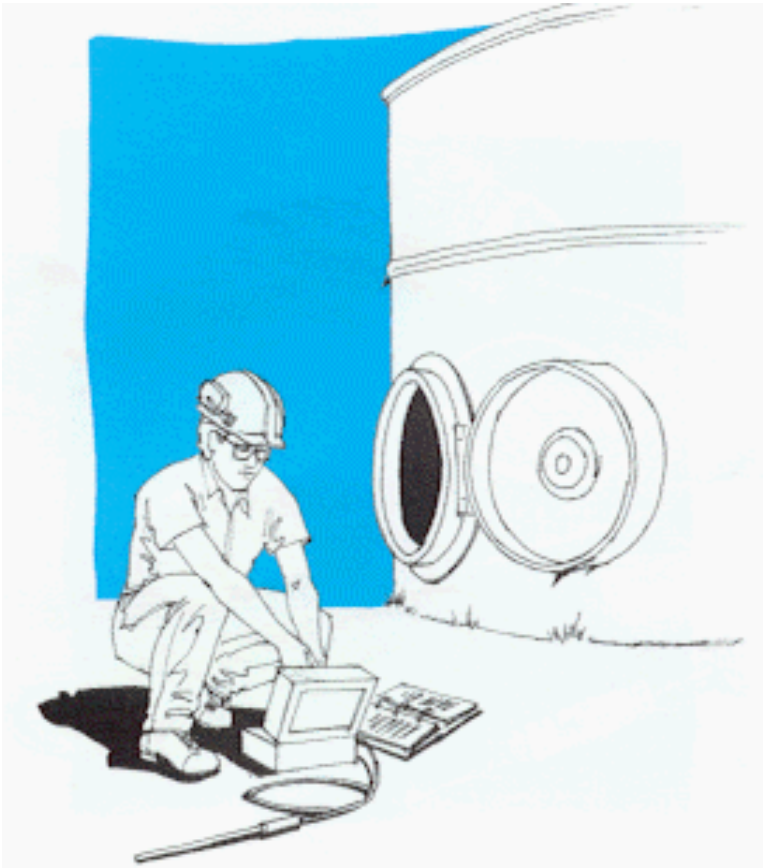
Testing

- **Atmospheric testing must be conducted:**
  - **as specified in written procedures**
  - **before entry**
  - **< 20 minutes before entry**
  - **if space vacated > 20 minutes**
  - **periodically for MODERATE & HIGH hazard atmospheres**
  - **continuously where practicable**
  - **continuously if flammables ~20% LEL**

Testing

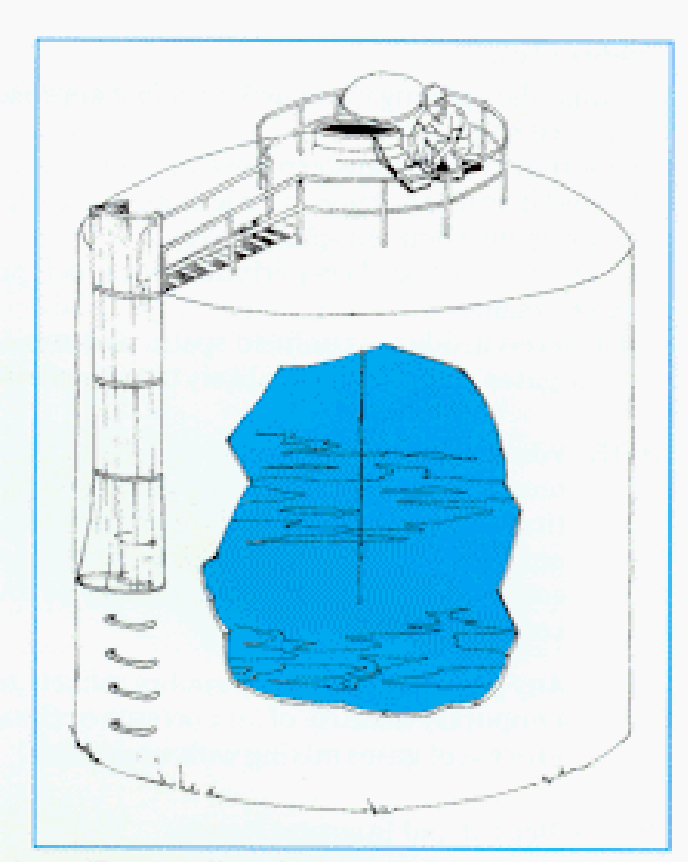


Testing



Testing

Testing



Testing

- **Pre-entry testing NOT required for LOW hazard atmosphere spaces if:**

  - location & controls ensure a hazardous environment will not inadvertently develop

  - such testing is not required to verify the effectiveness of an isolation or other pre-entry control

  - prior representative sampling has shown clean respirable air

  - written procedures do not require testing

Testing

Procedures, Equipment & Results

- **conducted in a *safe* manner according to procedures**
- **conducted by adequately trained worker**
- **equipment reliable, adequately serviced, calibrated & maintained**
- **test records to show date, time, initials of tester, levels & conditions found**
- **test results posted at *all* points of entry**

Cleaning, Purging, Venting

- where practicable, *clean respirable air* must be provided before entry
- dead-ends of isolated lines must be cleared of any harmful substance
- where clean respirable air cannot be provided:
  - PPE as necessary
  - flammables < 20% of LEL
  - sources of ignition controlled

Inerting

- **Written work procedures, must be submitted to the Board at least 7 days prior to entry into inerted spaces**
  - **entry precautions for HIGH hazard atmosphere must be followed**
  - **supplied-air respiratory protection used**
  - **all ignition sources controlled**
  - **atmosphere must remain inerted**

Ventilation

- **Continuous ventilation is *not* required for:**

  - intentionally inerted atmospheres

  - LOW hazard atmosphere space work when:

  *** the space is greater than 64 ft^3 per person and**

  *** space is occupied for < 15 minutes and**

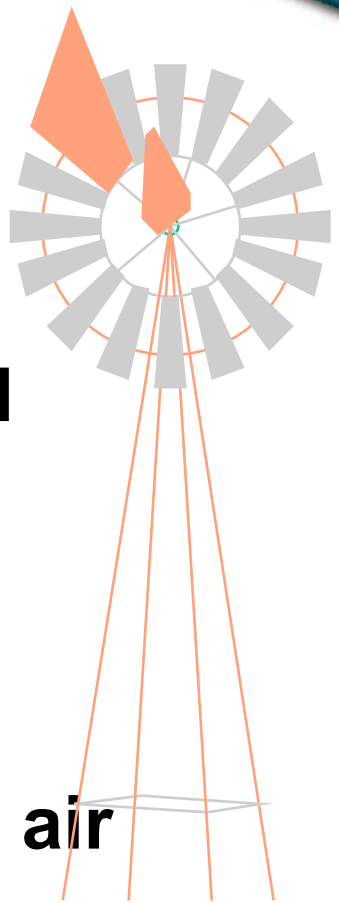
  *** work will not generate contaminants other than exhaled air**

  - an emergency rescue if not practicable

Ventilation

- Designed, installed and maintained according to engineering principles
- 50 cfm / worker for LOW hazard atmosphere
- specified in written procedures
- located and arranged to ventilate all occupied areas
- contaminants controlled at the source
- control contaminants below Exposure Limits (EL)

Ventilation



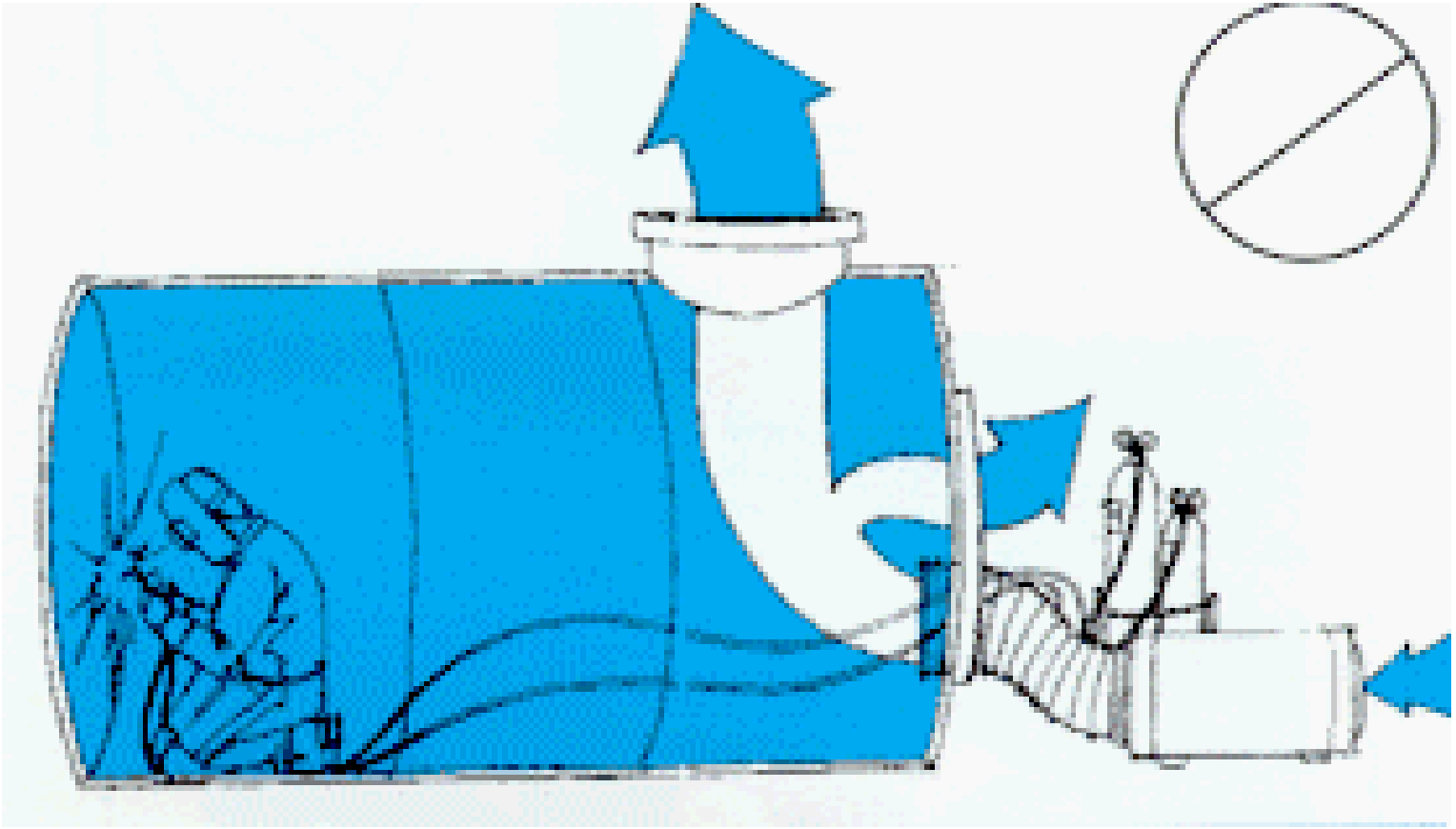
Natural ventilation may be used:

- **if airflow is monitored and**
- **contaminants are maintained below the Exposure Limit**

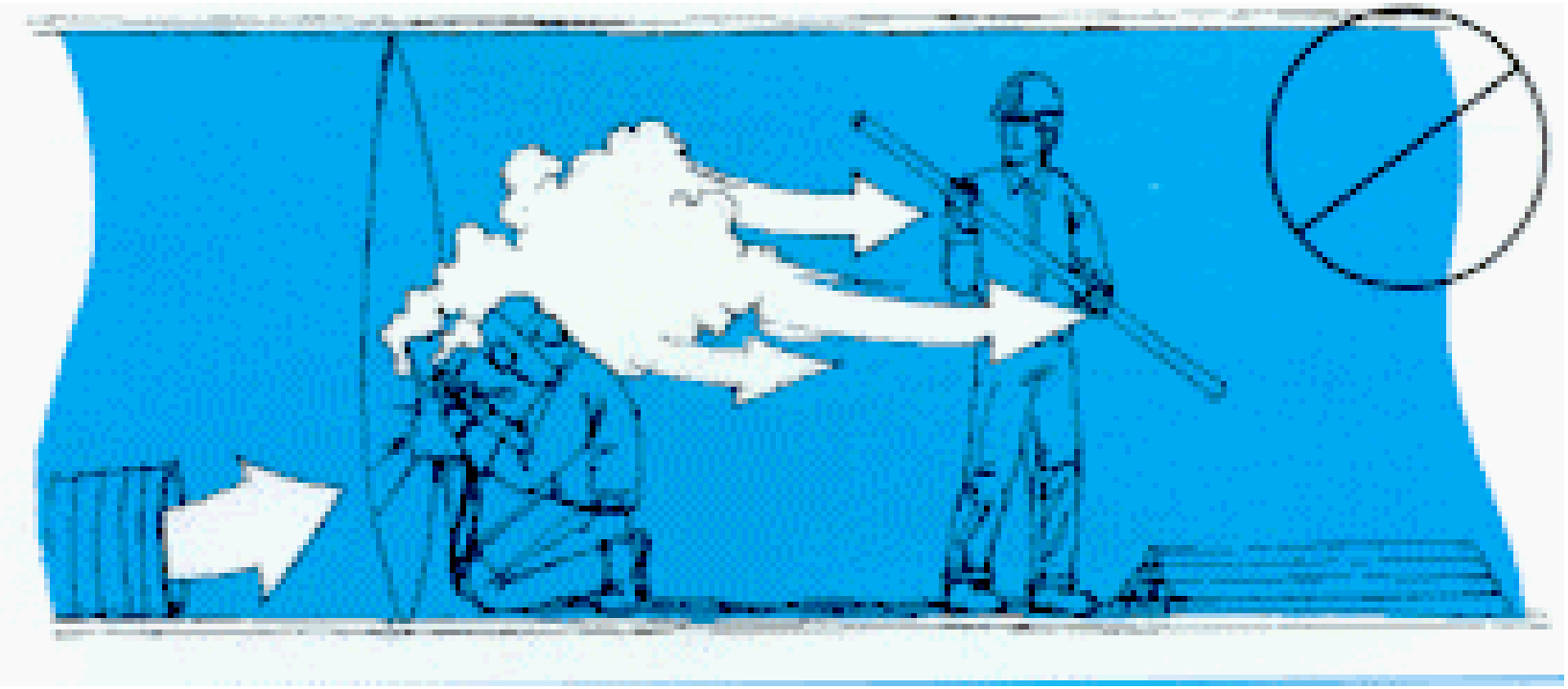
must not be used **:**

- **for HIGH hazard atmosphere**
- **if other than clean respirable air is drawn into the space**

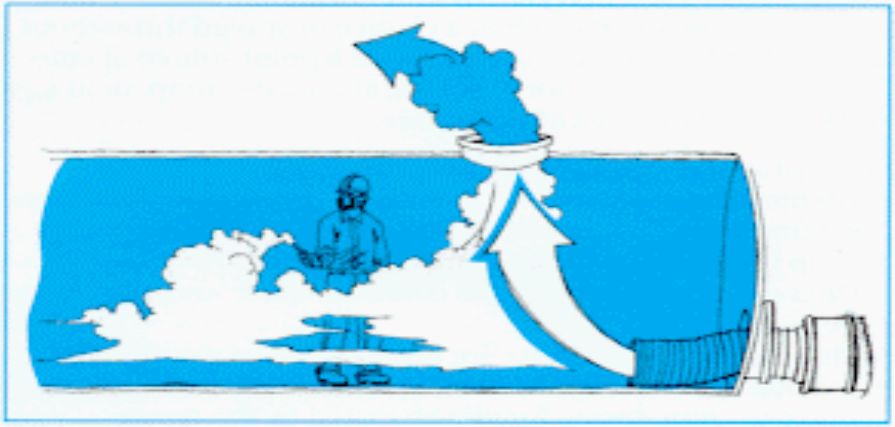
Ventilation: do's and don'ts



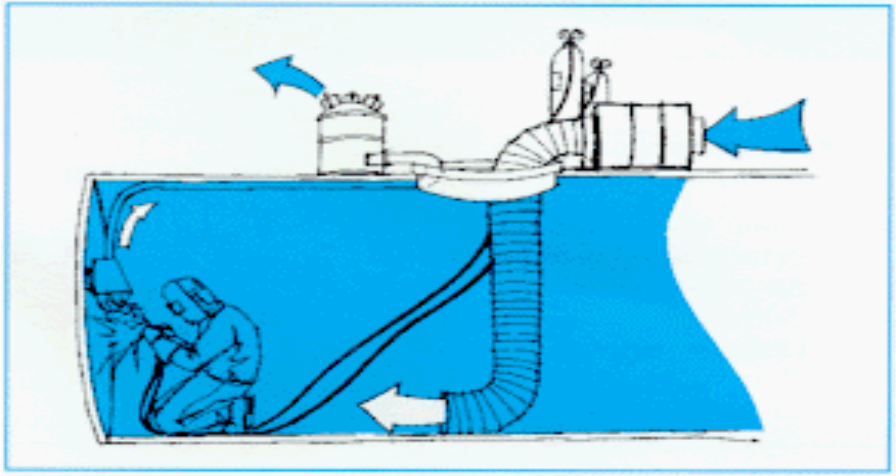
Ventilation: do's and don'ts



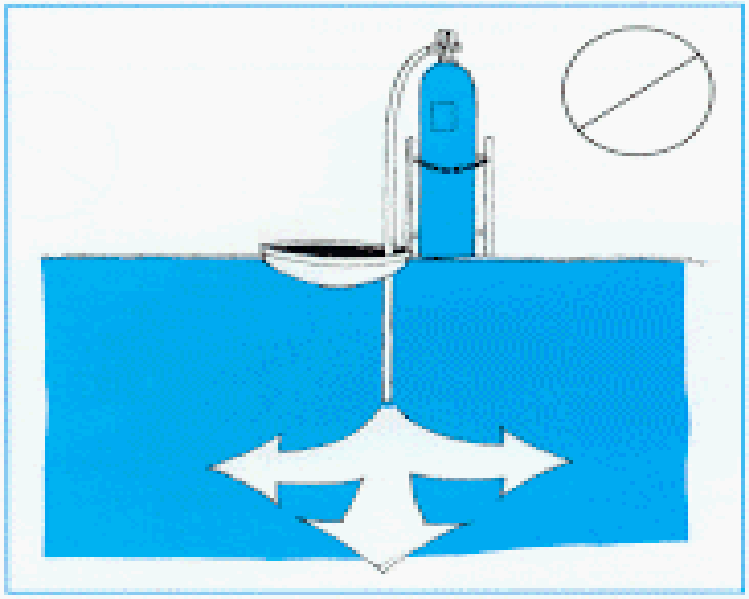
Do check for short-circuiting.



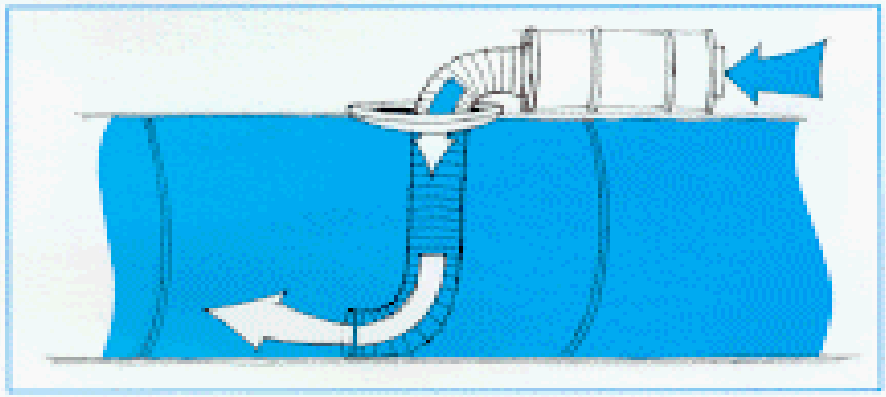
Do use local exhaust ventilation to supplement general ventilation when necessary for contaminant control.



Do not use oxygen for ventilation.



Do use positive pressure systems, where necessary, to increase effectiveness of ventilation.



Standby Persons

- **LOW hazard atmosphere**
  - **standby person must be assigned**
  - **continuous means of summoning**
  - **20 minute checks**
  - **immediate means to summon rescue personnel**

Standby Persons

- **MODERATE hazard atmosphere**
  - **standby worker(s) must be assigned**
  - **stationed at or near the entrance**
  - **visual or other check required at least every 20 minutes**
  - **continuous means of summoning standby worker**
  - **immediate means to summon rescue personnel**

Standby Persons

- **HIGH hazard atmosphere, Entrapment or Engulfment hazard**

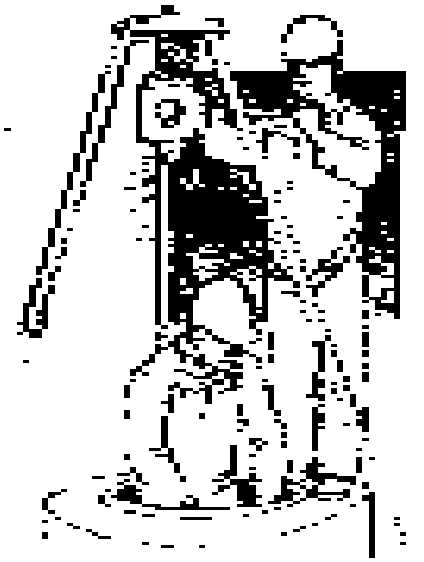
  - standby worker(s) must be assigned

  - standby person stationed at the entrance and assigned NO other duties

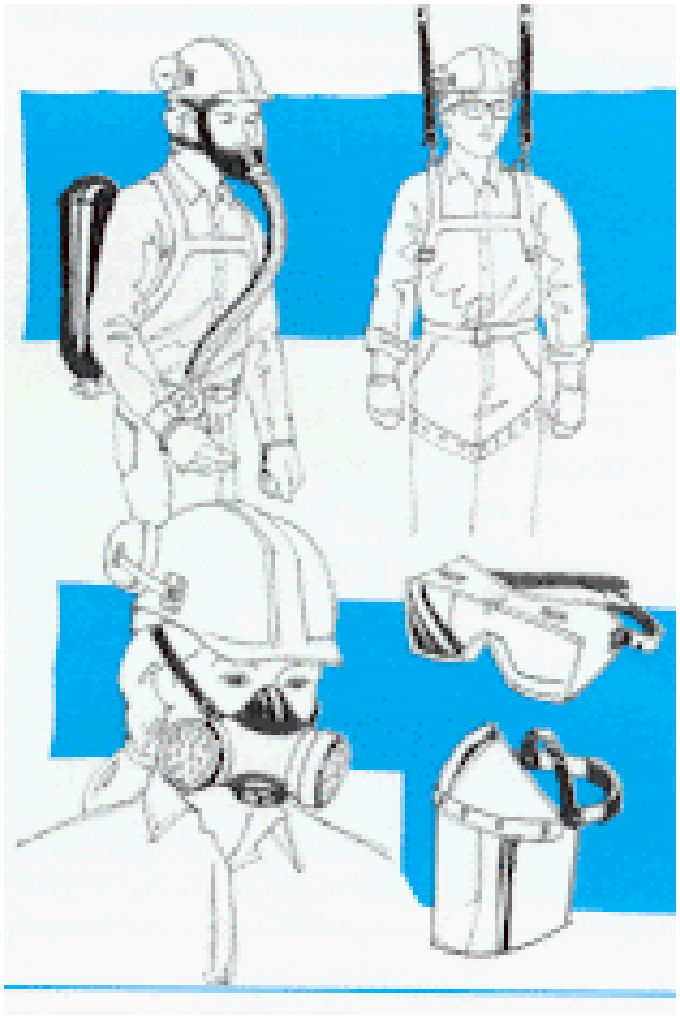
  - continuous visual or other check required

  - continuous means of summoning standby worker

  - capable of immediately effecting rescue



Rescue



Rescue

- **Rescue personnel**
  - **must be provided**
  - **written agreement required if another firm or the fire department is to be used**

Rescue

- **Equipment and training**
  - properly equipped and adequately trained
  - annual practice drills
  - records of training and drills must be maintained

- **Notification**
  - supervisor or standby person to notify rescue personnel before entry and upon exiting

Lifelines, Harnesses and Lifting Equipment

When required, and conditions of use

- **HIGH hazard atmosphere or entrapment hazard**
  - **Tended at all times by standby person**
  - **Lifting equipment if required**
  - **NOT required if obstructions or otherwise impractical**
- **Standards**
  - **Must meet requirements of acceptable standards**

Lifelines, Harnesses and Lifting Equipment

- **Line entanglement**
  - **must be addressed**
- **Additional workers**
  - **required if immediate rescue cannot be effected by standby person**
  - **stationed at the entrance**
  - **must be equipped and capable of entering space to effect rescue**

Personal Protective Equipment and Other Precautions

- PPE appropriate for work activity
- Emergency escape respirator
  - required for HIGH hazard atmosphere
  - must be carried or be within arms reach
- Compressed gas cylinders
  - NOT permitted inside confined space
- Torches & Hoses
  - must be removed when not in use or space vacated

Personal Protective Equipment and Other Precautions

- **Electrical equipment**

  - grounded or double-insulated-GFI protected in wet conditions

  - explosion safe if flammable or explosive gases, vapours or liquids are present

- **Non-sparking tools**

  - must be used where flammable or explosives are present

Questions?