MANITOBA LABOUR AND IMMIGRATION
WORKPLACE SAFETY AND HEALTH

Code of Practice

For Confined Space Entry Work

SAFE WORK
S SPOT THE HAZARD
A ASSESS THE RISK
F FIND A SAFER WAY
E EVERYDAY

Manitoba

Code of Practice

For Confined Space Entry Work

November, 2006

Manitoba

TABLE OF CONTENTS

INTRODUCTION

Preventing Confined Space Accidents

The Workplace Safety and Health Act, in part, states that it is the employer's responsibility to provide workers with information, instruction, training, supervision and facilities to ensure the workers' safety, health and welfare.

Refer to Part 15 of Manitoba Regulation 217/2006 for detailed regulatory requirements.

This Code of Practice provides employers with practical guidance on how to fulfill their obligations to protect the safety and health of workers where there is a requirement or permit for workers to enter into a confined space.

Acknowledgement:

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INTRODUCTION

Every year people die in confined spaces. In many of these cases, the result is multiple fatalities. For confined space entry work, there is a need to:

1. **Spot the hazard:** Identify confined spaces where workers may have to enter to work.

2. **Asses the risk:** Train workers to identify and assess hazards before they are exposed to them.

3. **Find a safer way:** Reduce, control, or eliminate hazards and find safer working methods.

You can work safely in a confined space if you make proper hazard / risk assessments and implement safe work procedures.

This Code of Practice will:

- Help in recognizing confined spaces
- Help in developing safe work practices and procedures for confined space entry
- Supplement the employer's regular training program for workers required to enter and work in confined spaces
- Help members of workplace safety and health committees in identifying and making recommendations on hazard assessment and control.

Always consider confined spaces to be immediately dangerous to life and health (**IDLH)** until hazard assessment is complete and control measures are in place.

DEFINITION

M.R. 217/ 2006 – Sec. 15
Confined space means an enclosed or partially enclosed space that:

(a) except for the purpose of performing work, is not primarily designed nor intended for human occupancy

(b) has restricted means of access or egress

(c) is or may become hazardous to a worker entering it (within it) because of:
  (i) its design, construction or atmosphere
  (ii) the materials or substances in it
  (iii) the work activities to be performed in it or processes used in it, or
  (iv) any other conditions or hazards relating to it

For the purposes of this code of practice, **hazard/risk assessment** refers to the process of identifying ways in which a worker may suffer harm while in a confined space.

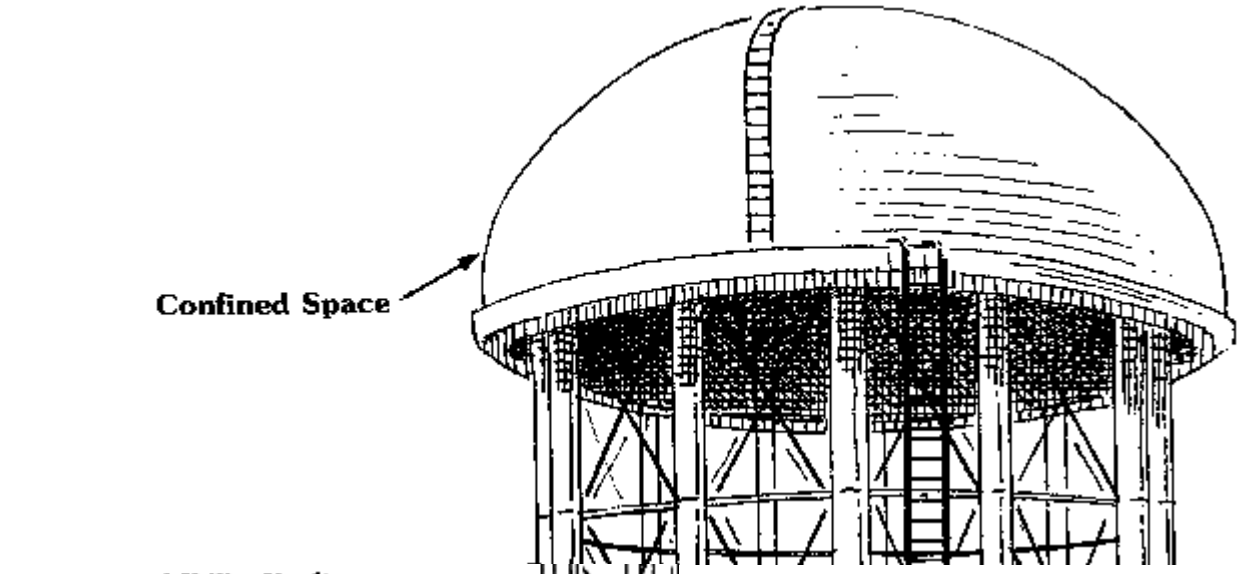
As a general requirement, employers must identify and take measures to reduce, control or eliminate hazards associated with confined spaces including:
(i) doing the work in a way that will not require a worker to enter the space
(ii) changing the physical characteristics of the confined space to ensure safe entry and exit

CONFINED SPACE HAZARDS – POTENTIAL FOR FATALITY

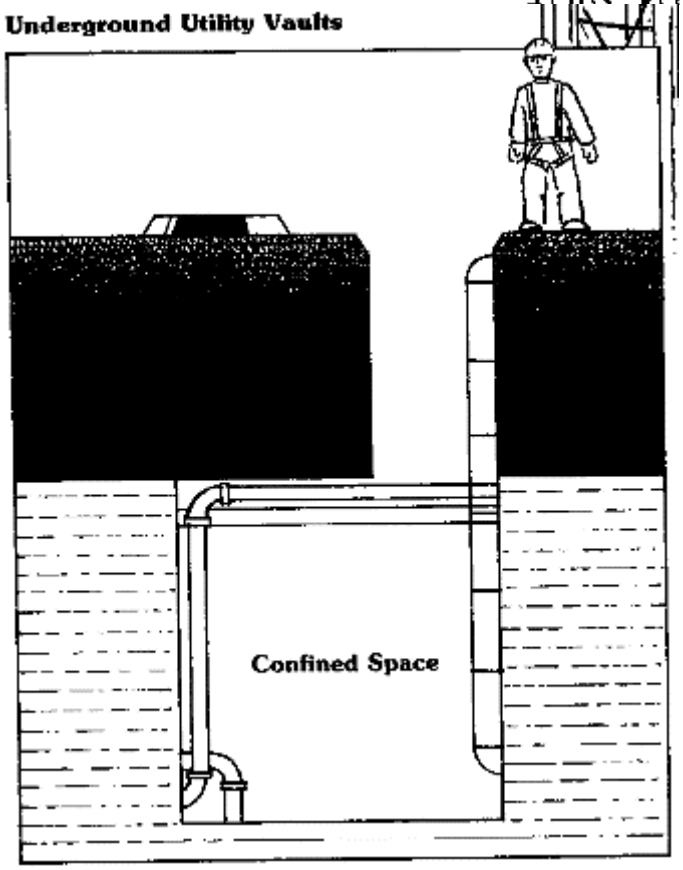
- Entering a tank without testing
- Entering a confined space and not ventilating it
- Using an inert gas to force a liquid out of a tank
- Using welding hoses and valves without periodically checking for leaks
- Using oxygen to ventilate confined spaces
- Not investigating the effects of stirring up sludge in a confined space
- Not using proper respiratory protection
- Not checking processes in the vicinity of the space for possible release of toxic or flammable substances
- Welding in a tank without checking neighbouring compartments
- Not blanking out, locking out
- Leaving a space that has been tested safe for entry and re-entering it later without retesting it
- Improper rescue procedures

SECTION A
EXAMPLES OF A CONFINED SPACE

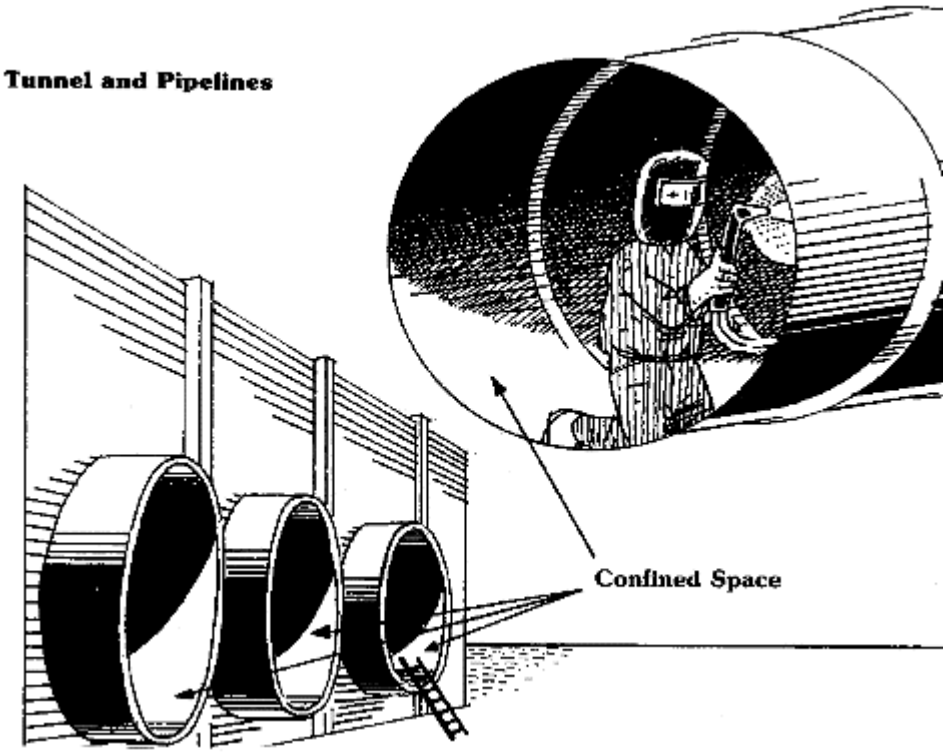
Storage tanks — Installations Above or Below Ground, Rail Tanks, Truck Tanks



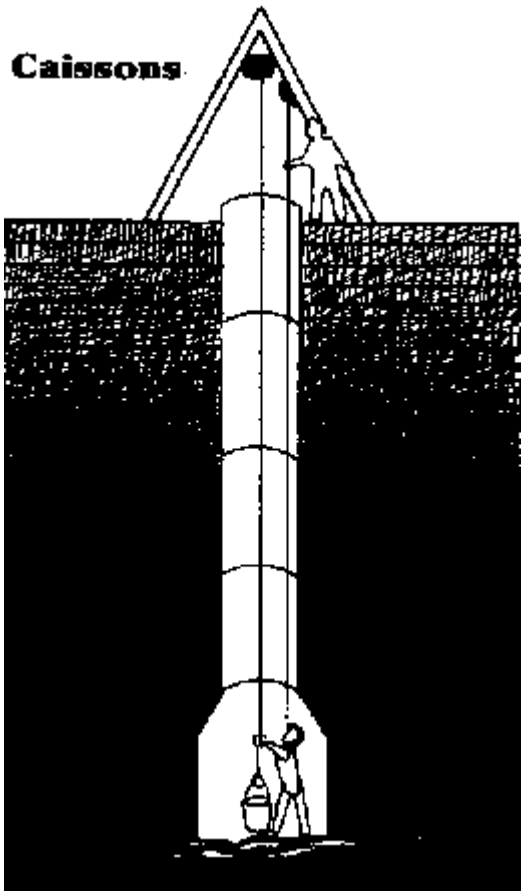
Underground Utility Vaults



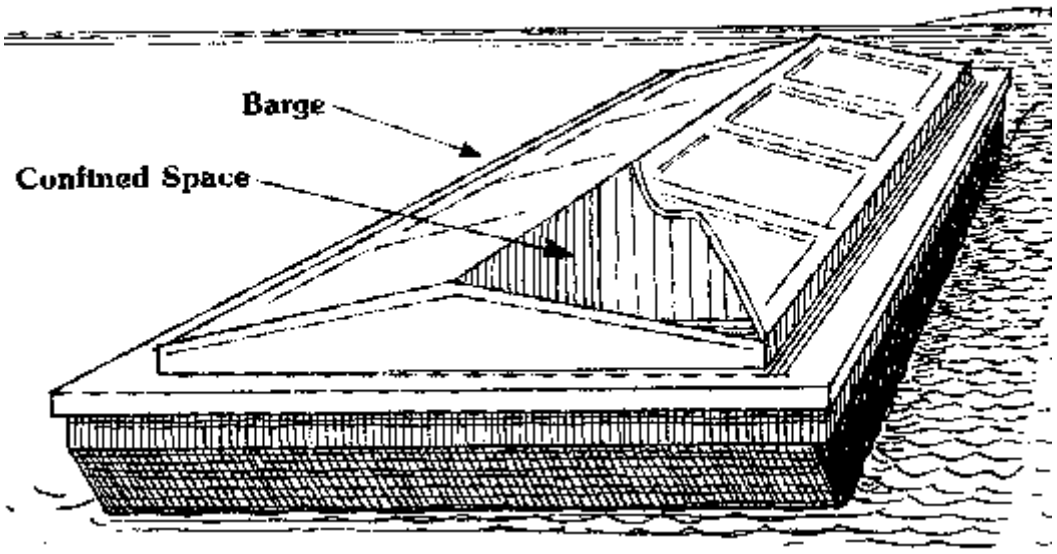
Tunnel and Pipelines



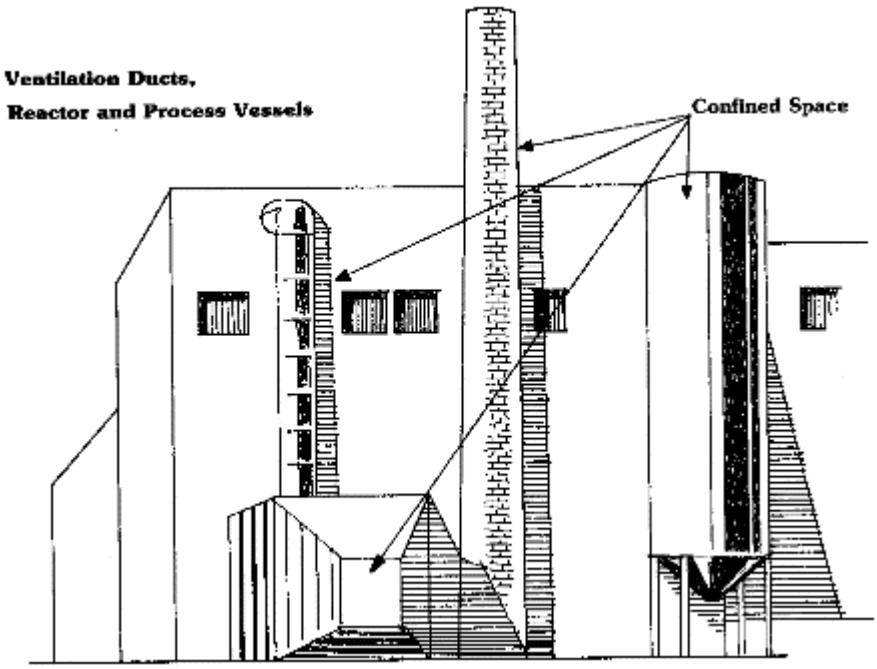
Caissons



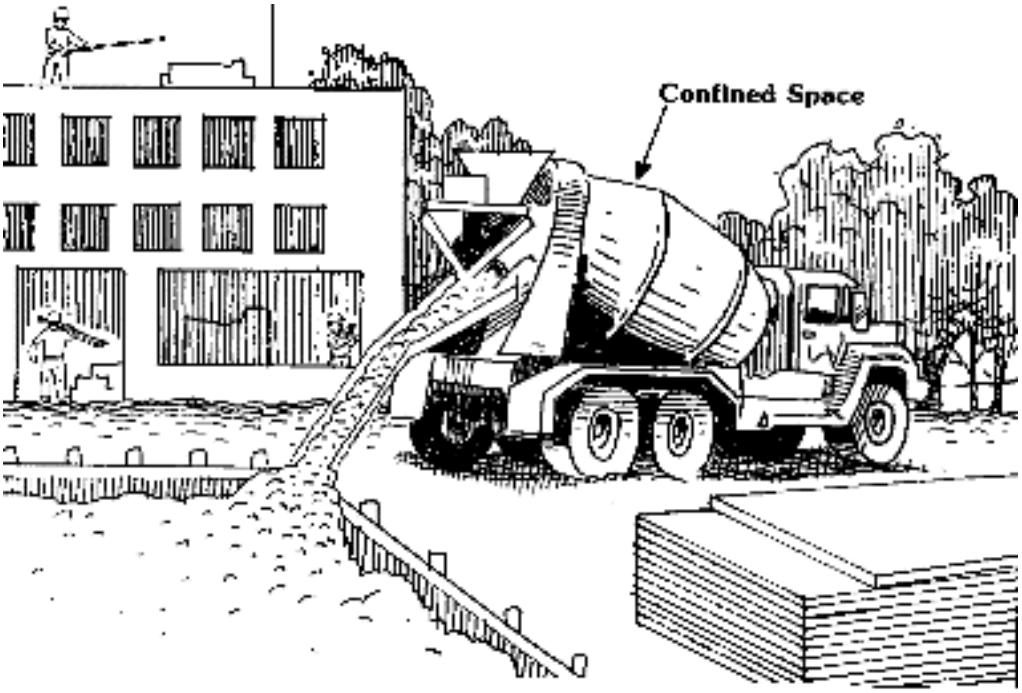
Holds, Ballast Tanks of Barges and Ships

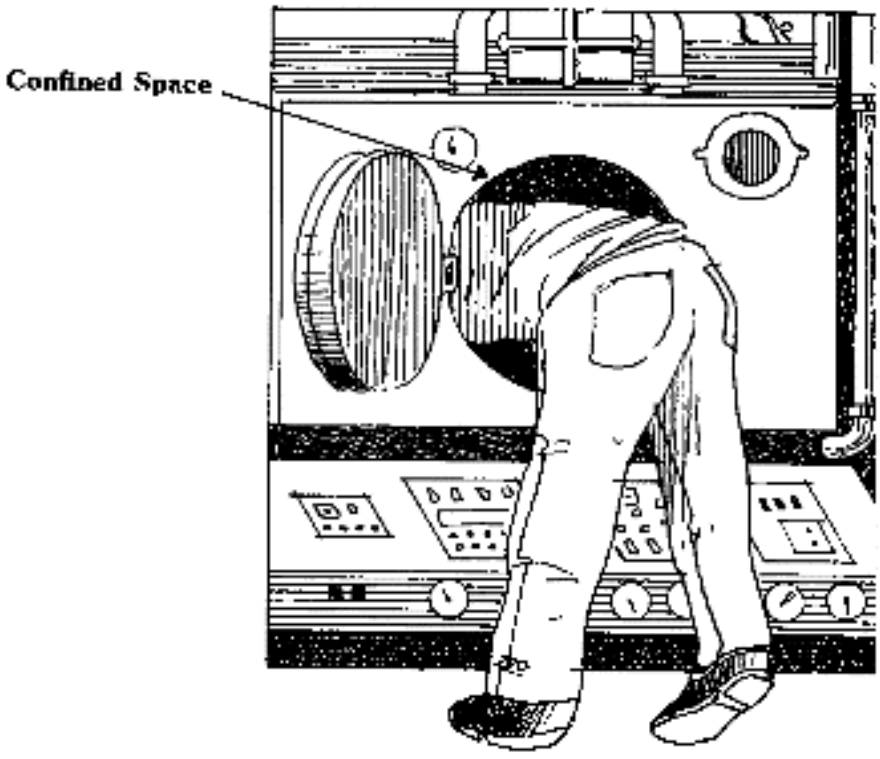


Ventilation Ducts, Reactors and Process Vessels

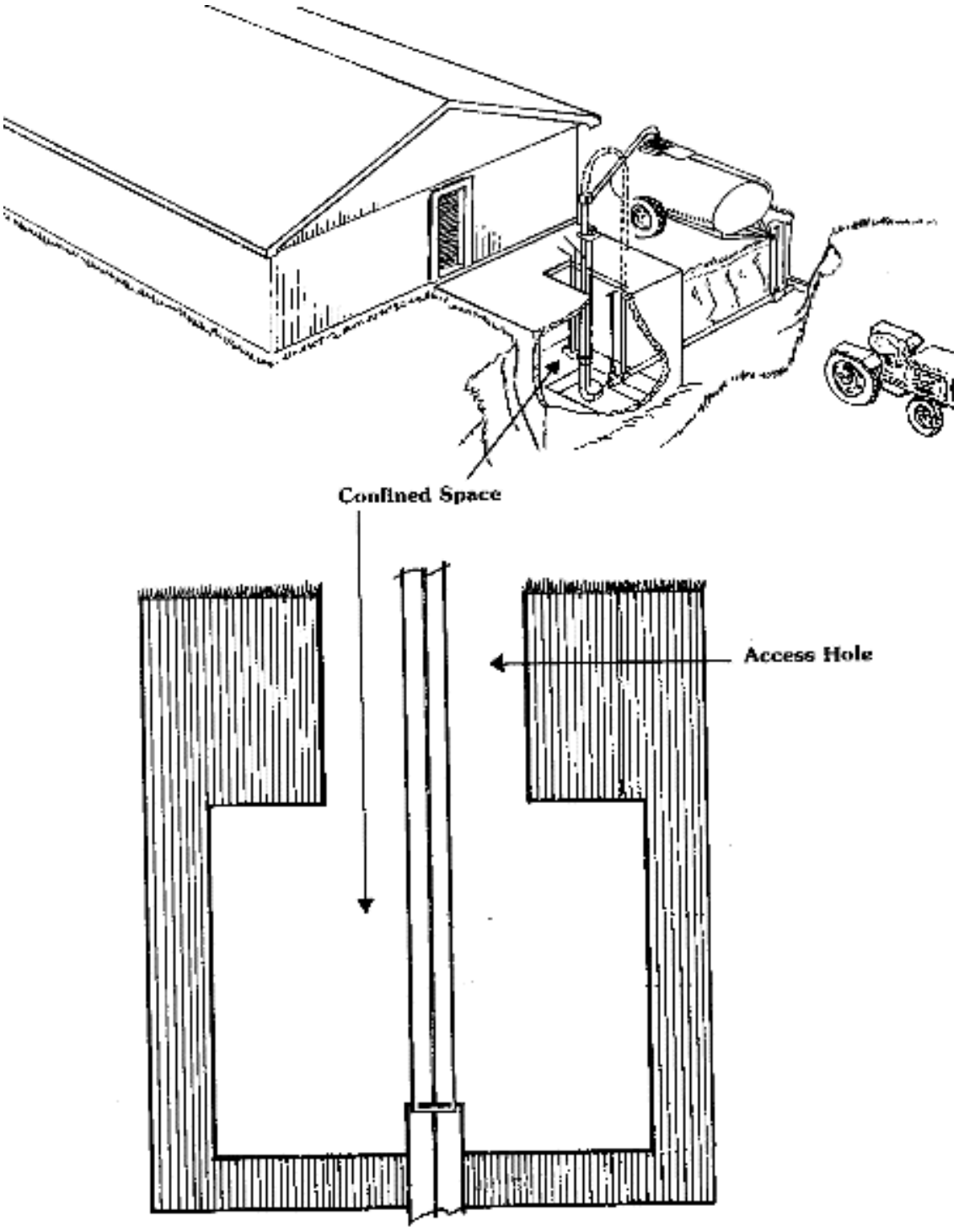


Machinery and Equipment

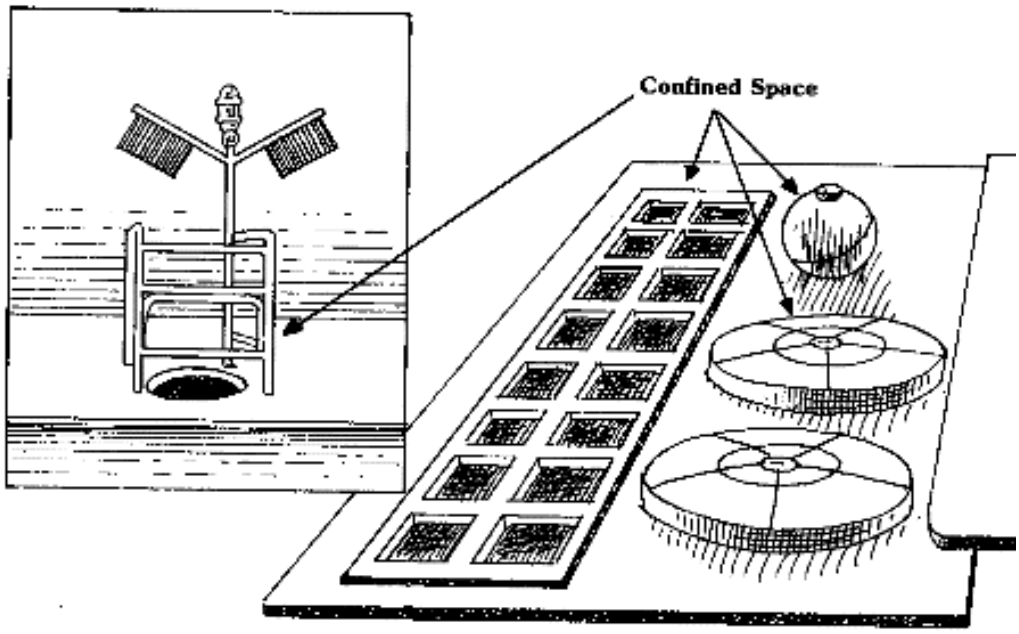




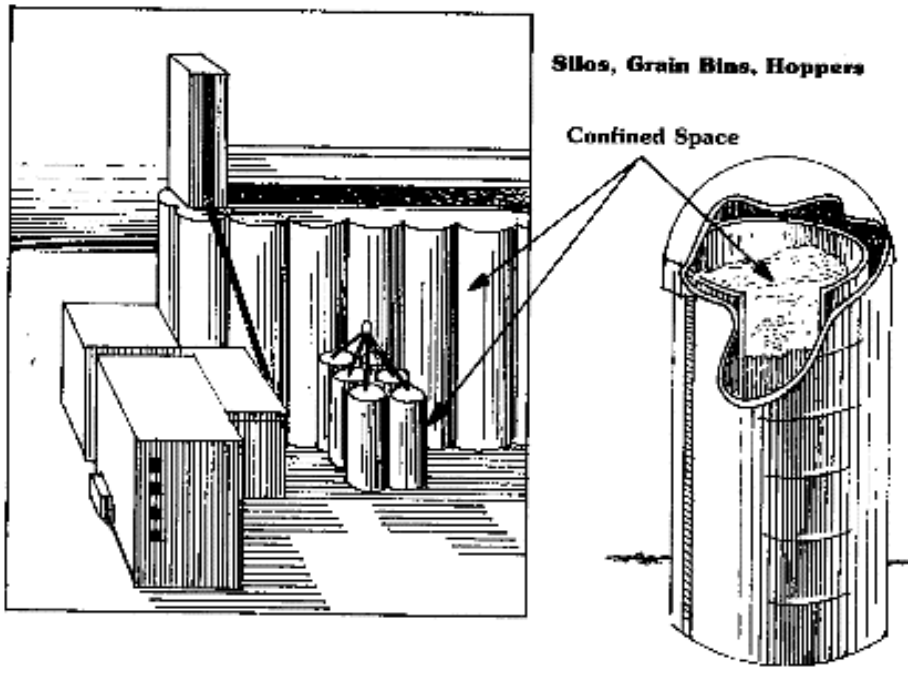
Manure Pits, Well Pits



Sewage Handling Systems



Silos, Grain Bins, Hoppers



It is recommended that employers identify and record confined space work areas at their workplaces.

A confined space work area recording sheet is provided in Appendix A to assist with the following:

a) identification of confined spaces
b) identification and assessment of potential hazards and risks
c) development of required safe work practices and procedures

Example #1:

A fuel storage tank 40 metres in diameter, and 15 metres high, with a ground level side hatch for access, requires cleaning and repair of the heater coil.

Confined Space	Hazards	Precautions
fuel storage tank	explosive atmosphere	use continuous explosive gas monitoring
	oxygen deficiency	oxygen monitoring/ventilation
	welding	hot work permit
	access/egress	emergency rescue provisions
	fluids entering tank	blanking off lines and locking off valves

Example #2

manhole	explosive gases	continuous explosive gas monitoring
	oxygen levels	oxygen monitoring
	unknown toxic gases	supplied air breathing apparatus
	residual chemicals on sewer pipe	supplied air and continuous explosive monitoring
	chemicals in effluent (live sewer)	supplied air, explosive gas monitoring and full skin (dermal) protection
	micro organisms	supplied air, personal hygiene and immunizations (occupational health service)
	access/egress	hoisting/retrieving system and harness and lifeline; standby worker equipped with supplied air and emergency rescue provisions, third worker present
	slippery rungs, surfaces	footwear and traction/grip, hoisting/retrieval system. harness, lifeline and standby worker equipped

SECTION B
HAZARD/RISK IDENTIFICATION - CONSIDERATIONS

A) Atmospheric (within the confined space)

- Explosive gases/vapours
- Toxic gases/vapours
- Oxygen content
  - deficiency
  - enrichment
- Fumes, dusts, mists, fogs
- Smoke
- Biological agents

B) Safety hazards

- Entry/exit
- Ventilation systems
- Machinery
- Piping/distribution systems
- Residual chemicals/materials
- Electrical
- Visibility
- Physical obstacles
- Walking/working surfaces
- Temperature extremes
- Humidity
- Noise
- Vibration
- Radiation
- Hazardous animals

C) Work to be performed

- Hot work/cold work

D) Human factors

- Phobias
- Mental and physical condition of workers

SECTION C
HAZARD ASSESSMENT (cont'd)

Hazard	Explanatory Notes	Methods of Test	Effects of Hazard	Examples
A. Atmosphere				
1. Explosive Atmosphere	Before entering a confined space, tests for presence of an explosive atmosphere must be done. It should be noted that air-borne dust from grain, fine ground metals or other materials can form an explosive atmosphere. Explosive gases may displace oxygen. Note: Oxygen enrichment or deficiency can cause error in combustible gas detector readings.	Use a combustible gas detector. Monitor explosive gases by using equipment that can detect the lower explosive limit (LEL) and upper explosive limit (UEL). Residuals may have to be disturbed to allow the release of explosive gases.	Explosion, burns, multiple injuries, death	1. Methane (natural gas) CH_4 sources: gas line leaks, decaying matter. May be found adjacent to land fill sites, backed up or sluggish sewers. 2. Gasoline and other solvents: storage tanks and adjacent areas, sewer systems proximity to pipelines, accidental spills. May have definite odour.
2. Oxygen a) Deficiency	Deficiency - acceptable breathing air contains between 19.5 per cent and 23 per cent oxygen. Air containing less than 19.5 per cent of oxygen by volume is a hazardous atmosphere.	Oxygen detection monitor.	Could result in slowing down of pulse rate, disorientation, unconsciousness, and death.	Oxygen (0_2) deficiency can occur when it is displaced by other gases, or by biological or chemical reactions, such as rusting or burning.
b) Enrichment	Enrichment means an atmosphere where the oxygen content is greater than 23 per cent by volume. Oxygen enrichment can cause an error in explosive meter readings	Oxygen detection meter. Note: Some equipment is not capable of detecting oxygen enrichment.	This creates an explosive atmosphere and increases rates of chemical reactions. **If the oxygen content can not be reduced to less than 23 per cent, do not allow entry.**	Enrichment may occur through the improper blanking of oxygen lines, leaking fuel gas welding equipment or ventilation with oxygen instead of air
3. Toxic Gases, Vapour	To create and maintain a safe environment, appropriate detection equipment must be used to determine the presence of toxic gases.	Monitors: specific testers must be used for specific toxic gases, ex: H2S monitoring. It may be necessary to disturb residue or sludge to allow release of toxic gases and vapours.	Can cause euphoria, disorientation, drowsiness, headaches, weakness, injury, disability and death.	1. Carbon monoxide (CO) is colourless, odourless, tasteless and extremely poisonous. The most common sources of CO are poorly adjusted and maintained combustion devices.

HAZARD ASSESSMENT (cont'd)

Hazard	Explanatory Notes	Methods of Test	Effects of Hazard	Examples
A. Atmosphere				
				2. Carbon dioxide (CO_2) is odourless. It is a heavy gas that concentrates at lowest levels. It displaces oxygen and does not diffuse or mix readily with air. 3. Nitrogen dioxide (NO_2): a pungent, acrid odour, a product of gasoline and diesel engines. 4. Hydrogen sulphide (H_2S) is a deadly gas commonly found in sewers and manure pits. It is produced by decomposing organic matter. It has a typical rotten egg odour, but high levels can shut down the sense of smell.
4. Fumes, Dusts, Mists, Fogs	These hazards can often be seen.	Use specific monitors or testers for each fume, dust, mist or fog.	Explosion, disability, injury, burns, irritation, poisoning and death	1. Fumes: from asphalt, welding, acid fumes from washing processes. 2. Dust: grain dust, sandblasting (silica) 3. Mist: spraying applications
5. Smoke	Smoke is a combination of gases, vapours, fumes and dusts	Can be seen. Use appropriate detection and monitoring equipment to determine presence of toxic agents.	All effects of gases, dusts, vapours, mists, fumes	Result of combustion, ex: burning materials, smoke from welding
6. Biological Agents	Biological agents are found in a variety of locations. Take extreme care when working near health care facilities or industrial processes using biological agents. Conscientious personal hygiene is essential.	Testing for presence of biological agents is very difficult. If you know the type of agent, then perform the specific testing.	Ill health, disease, disorders, irritation and death.	1. Bacterial and viral infections.

HAZARD ASSESSMENT (cont'd)

Hazard	Explanatory Notes	Methods of Test	Effects of Hazard	Examples
B. Safety Hazard				
1. Entry/Exit (Access/Egress)	Openings that are small, narrow or otherwise difficult to negotiate can be a serious hazard. When using self-contained breathing apparatus, openings must be of a size to allow worker with equipment properly worn to pass through. Access openings less than 700 millimetres (28 inches) are not recommended.	Visual identification of obstructions that could interfere with normal movement or emergency rescue.	Injury, disability, and death	1. exits at height that could cause falls 2. constricted openings 3. angled openings 4. exits into traffic and machinery 5. exits at deep depths
2. Ventilation Systems	Lack of adequate ventilation may cause a build-up of contaminants. Ventilation systems can introduce hazards into the work area, ex: carbon monoxide (CO) fumes.	Monitoring (anemometer, smoke tubes for air movement). Toxic monitors may also be necessary to ensure good quality air.	Explosion, disease, irritation, injury, disability and death	Improper ventilation can result in: 1. oxygen level variations, 2. build up of toxic gases, vapours, dusts, mists, fumes smoke. 3. introduction of biological agents, toxic gases, explosive gases.
3. Machinery/ Mechanical Equipment	Make sure equipment is immobilized (de-energized) so that it will not be a hazard to workers.	Visual and function testing	Injury, disability and death	Drive belts, augers, paddles, scrapers, agitators and pumps
4. Piping/Distribution Systems	Contents of pipes and supply lines, if allowed to enter a confined space can create a life threatening situation for workers.	Monitoring, visual	Chemical poisoning, drowning, burns, injury, disability, death	Steam lines, liquid distribution lines, feed mills and cement plants
5. Residual Chemicals/ materials	1. Residual corrosive or toxic chemicals. Ensure all lines, valves, and meters are completely drained and properly decontaminated.	Monitoring	Injury, disability, death, explosion	Storage tanks, digesters, liquid distribution systems, augers.

HAZARD ASSESSMENT (cont'd)

Hazard	Explanatory Notes	Methods of Test	Effects of Hazard	Examples
B. Safety Hazard				
	2. Material that may be adhered to surfaces/walls of enclosures may collapse. 3. Loose granular material that may engulf worker. 4. Material that may encapsulate/trap other toxic/explosive materials. 5. Flooding by liquids.	Visual, monitoring	Engulfment, suffocation - drowning, injury, disability, death.	1. Silos, grain hoppers, fertilizer storage. 2. Sand, grains (ex: flax) 3. Rust build up of hydrogen sulphide (H_2S) 4. Flooding in underground facilities.
6. Electrical	Unguarded electrical equipment. Take extreme caution when using conductive material around electrical surfaces (ex: metal ladders, lifelines, steel bars)	Testing conducted only by qualified personnel	Electrical shock, burns, injury, disability and death	1. Underground electrical vaults and electrical distribution systems. 2. Motor control centres.
7. Poor Visibility	Poor lighting, obstructions, work process and procedure, fog/mist due to high humidity.	Visual	Injury, disability and death	Improper/inadequate lighting, poor design of confined space, work process.
8. Physical Obstacles	This would include obstacles that impede movement and performance of work and rescue procedures.	Visual	Inability to remove injured worker, contusions, abrasions, fractures, disability, injury, death.	Cross bracing, baffle plates, piping.
9. Walking/Working Surfaces	Surfaces that are irregular in shape, sloped, angled, elevated, slippery, or obstructed are slip and fall hazards. Work areas may require toe boards to prevent objects from falling on workers below.	Visual	Injury, disability, and death	1. Lift stations, aqueducts, dams 2. Work areas that require toe boards to prevent objects from falling on workers below.

HAZARD ASSESSMENT (cont'd)

Hazard	Explanatory Notes	Methods of Test	Effects of Hazard	Examples
B. Safety Hazard				
10. Temperature Extremes	Temperature extremes have definite health and safety hazards, as well as having a limiting effect on the ability of a worker to perform tasks adequately.	Thermometer, heat stress, wet bulb globe thermometer (WBGT)	1. Frost bite, loss of co-ordination, hypothermia, disability, death. 2. Heat exhaustion, heat stress, disorientation, death.	1. Working in freezers, extreme cold climate conditions. 2. Working in boilers, super-heated areas (cooling towers), and areas with steam/heat distribution pipes.
11. Humidity	High humidity can aggravate several conditions: 1. Visibility 2. Can cause all types of surfaces to become slippery. 3. Accelerates heat loss. 4. Increases chill effect.	Hygrometer	Such conditions can cause slips, falls, physical discomfort, heat exhaustion, affect performance of tasks.	1. Boiler rooms 2. Digesters 3. Freezers
12. Noise	If sound levels exceed 80 decibels, then work practices shall conform to requirements of current regulations respecting hearing conservation and noise control in workplaces.	Sound level meters	Distraction, stress, disorientation, communication problems, hearing loss.	Sources include operating equipment, such as jack hammers, pumps, grinders, other work procedures.
13. Vibration	Whole body vibration can affect and place stress on multiple body parts/organs.	Vibration meter	White finger disease, disorientation, vertigo, circulation and nervous system disorders.	1. Jack hammers, impact hammers/drills, and shakers.
14. Radiation	1. Non-Ionizing radiation - ultraviolet light, infrared light components or sunlight.	1. Non-ionizing - specific light meters.	1. Non-ionizing topical burns.	1. Ultraviolet and infrared light sources.

HAZARD ASSESSMENT (cont'd)

Hazard	Explanatory Notes	Methods of Test	Effects of Hazard	Examples
B. Safety Hazard				
	2. Ionizing radiation. Radioactive materials (uranium) Types: Alpha, Beta, Gamma	2. Ionizing - Geiger counters, passive dosimeters	Ionizing - deep body burns, radiation sickness, sterility, death	1. X-ray equipment 2. level or density gauges in manufacturing processes
15. Hazardous Animals	Rats, pigeons, deer mice and other vermin and their by-products (excrement).	Visual	Respiratory disease, injury, ex: hantavirus, histoplasmosis	rats, pigeons, bats, deer mice
C. Type of Work to be Performed				
	1. The type of work undertaken can create additional hazards. Consider and plan for the hazards created by the work process. 2. Hot work, where the heat used or generated by the work process may cause an explosion. 3. Cold work, a situation where toxic substances or other hazards may exist.	Monitoring, visual, pre-job planning, work permit system.	Injury, disability, death	1. welding (hot work) 2. sand blasting 3. bonding operations 4. grinding 5. using solvents 6. spray painting
D. Human Factors				
1. Phobias	Some workers are not suitable for work in confined spaces. As a result of these factors they can cause injuries to themselves or others.	Medical interview screening	Injury, disability, death	1.claustrophobia 2. fear of heights
2. Mental & Physical Condition	All workers must be mentally and physically capable of performing the work.	Visual, medical examination (pre-employment, annuals)	Injury, disability, death	1. intoxication (alcohol, drug abuse) 2. impairment (prescription medication)

SECTION D

SAFE WORK PRACTICES AND PROCEDURES

By developing and implementing safe work procedures, employers ensure that all workers involved in confined space entry work follow standardized methods, reducing the risk of injury or death. These procedures will include emergency response plans and rescue procedures to be followed in the event of an accident or other emergency in a confined space.

Training

Confined space work requires an effective training program that will provide awareness of safe work procedures. Base the training program on the specific hazards identified. Provide the training to all individuals who supervise workers, perform the work, or those assigned as standby or rescue persons.

a) Trainers - It is essential that the training instructor have a thorough working knowledge of the following:
   I. the confined space associated with the work activity
   II. hazards involved
   III. work practices and procedures
   IV. atmospheric testing and monitoring requirements within the confined space
   V. safety equipment, e.g. respirators; clothing, additional protection
   VI. emergency response and rescue
   VII. evaluation

b) Workers - Training of workers entering and working in confined spaces is critical. To ensure worker safety, design the training program specifically for the type of confined space involved; the problems associated with normal entry and exit; and rescue procedures. Training should cover all types of confined spaces that may be encountered in the workplace or job description.

An effective training program will cover the following:

- Safe work practices and procedures for working in the confined space including:
  I. personal protective and safety equipment
  II. communication procedures – standby worker/worker/emergency
  III. procedures for isolating, mechanical and electrical lock out, blanking, disconnecting pipes, lines and sources of energy
  IV. emergency response and rescue procedures
- Recognizing the hazards associated with working in the confined space
- The content and control measures outlined in the required entry permit

Effective training can take place on the job, in classrooms and in simulated conditions. The employer must closely supervise on the job training until the worker has a complete understanding of potential hazards and has a complete understanding of confined space work practices.

The employer must evaluate worker competency to determine the need for re-training and upgrading. This should be done periodically, based upon employee evaluation and changes in the workplace.

Rescue

Always consider confined spaces to be immediately dangerous to life and health (IDLH), unless proven otherwise. Plan and prepare emergency response and rescue procedures for all confined space entry work. These procedures must be in place before any work commences. Take note that a very short period, approximately four minutes, without breathing can cause a worker to suffer permanent brain damage due to lack of oxygen.

For confined space entry, the employer must designate as a standby worker, one or more workers who are qualified in first aid level 1, 2, or 3 and trained in confined space work and emergency and rescue procedures. The designated standby worker must be present and remain at the entrance to the confined space at all times while a worker is in the confined space.

The employer must equip the standby worker and the worker in the confined space with suitable systems allowing them to communicate directly with each other and summon additional emergency assistance when necessary.

WORKERS WHO ARE NOT TRAINED IN PROPER RESCUE PROCEDURES SHALL NOT UNDERTAKE OR BE PERMITTED TO UNDERTAKE RESCUE OPERATIONS.

Worker to comply

An employer must ensure that a worker who is required or permitted to enter a confined space complies with the safe work practices and procedures respecting work in such a space.

Entry Permit System

The purpose of the entry permit system is to ensure proper identification of existing hazards in a confined space. It also ensures that necessary preventive and protective measures and procedures are in place to protect the health and safety of workers involved in confined space entry work.

The entry permit system, established by the employer, provides a checklist to verify that all hazards associated with work processes are taken into consideration.

The entry permit must be complete and signed by a competent person; and be readily available at the site of the confined space before a worker enters that confined space. It must contain the following information:

a) Location of the confined space

b) Names of each worker who will enter the confined space, the reason for their entry and the work that they will do

c) Time during which the entry permit is valid. Entry permits will display the issue date and time of the permit and have an expiration time that will be valid for only one shift. Each shift shall have the permit updated.

d) Safe work procedures for entering, being in, and leaving the confined space

e) Complete isolation list
- blanking and/or disconnecting
- electrical lock-out
- mechanical lock-out
- any other applicable information

f) Special clothing and equipment
- personal protective equipment and clothing
- full body harness, lifeline, and retrieval system
- special tools for hazardous location work

g) Atmospheric test readings
- explosive levels and/or flammability levels
- oxygen levels – deficiency or enrichment
- toxic substances
- others, as necessary

h) Atmospheric monitoring, including type, while work is being performed

i) Trained personnel, with a complete understanding of the hazard

j) Standby workers must be named on the permit

k) Signed authorization by the supervisor (competent person) for work to be done

l) First aid provisions, emergency response and rescue procedures in place

Because of the diversity of work in confined spaces, it is not possible to have an entry permit that covers every situation. Assess each work situation and design a specific entry permit to cover it.

The employer must review and revise the confined space entry permit whenever the work activity changes or circumstances at the workplace change in a way that poses a risk to the safety and health of a worker. The employer must also inform workers, who may be affected by the change to an entry permit, of the change.

The employer or owner must take all practical and reasonable steps to prevent any person, other than a worker who is required or permitted to do so, from entering a confined space at the workplace.

Examples of the various types of work permits include:

a) Hot work permit - where heat used or generated in work process is of sufficient intensity to cause an explosion or fire
b) Cold work permit - where hazards from toxic gases. Fumes, dusts, mists, fogs, corrosive substances, biological agents exist or may exist
c) Safety work permit – for work that involves steam, air, water, electricity
d) Entry permit - for entering into confined spaces

See an example of an entry permit in Appendix B.

Lock out Provisions

Refer to Part 16 section 16.14 of Manitoba Regulation 217/2006 for full lock out requirements.

Lock out means the disconnection, blocking or bleeding of all sources of energy that may create a motion or action by any part of a machine and its auxiliary equipment.

Before a worker undertakes confined space entry work/activities, the employer or contractor shall ensure that all of the systems, that are part of the confined space, are disconnected from the power source at the disconnect box and that the controls are locked out, and remain locked out, to prevent accidental start-up. Systems include electrical, mechanical, steam, compressed (pneumatic) gas, hydraulic, gravity, wind, and radiation devices

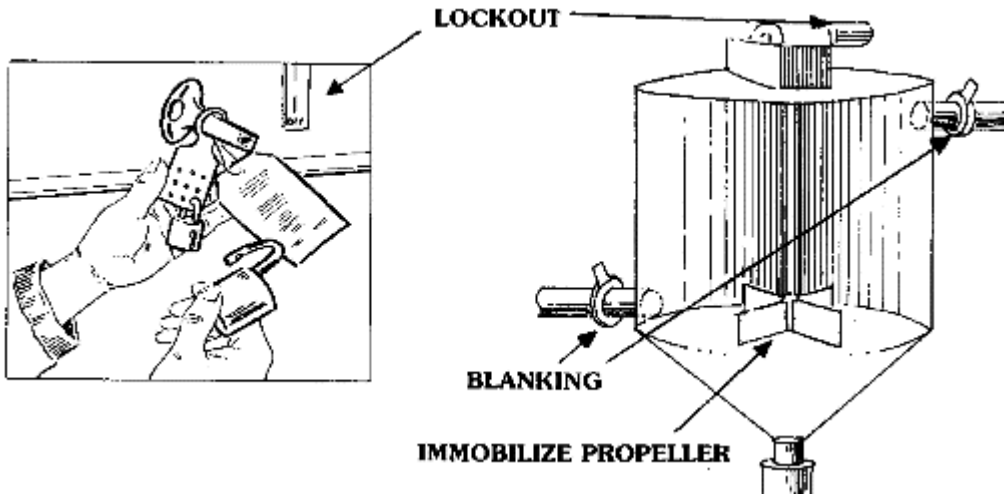
An employer must develop and implement safe work procedures for the service, testing, repair and adjustment of a machine when

- the manufacturer's specifications require the machine to remain operative when it is serviced, tested, repaired or adjusted
- there are no manufacturer's specifications and it is not reasonably practicable to lock out the machinery when it is serviced, tested, repaired or adjusted

Blanking Off Procedures

The employer must ensure all lines and systems that may allow hazardous materials to enter a confined work space are blanked off. Material used in the construction of the blank must take the line pressure and corrosion properties into consideration.

Where it is impractical to employ blanks or blinds, as in welded piping systems, develop and implement safe work procedures that ensure equivalent protection for all workers exposed to the hazard.



<u>NOTE</u>: ENSURE THAT YOU HAVE LOCKED OUT ALL ENERGY SOURCES THAT PRESENT A HAZARD TO A WORKER ENTERING, OCCUPYING, OR LEAVING THE CONFINED SPACE, AND PUT THOSE ENERGY SOURCES IN A ZERO ENERGY STATE.

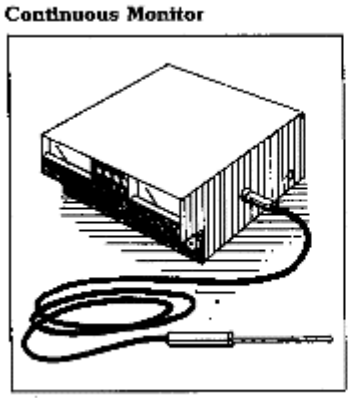
Monitoring

Before entering any confined space, it is important to use appropriate monitoring equipment, determine the frequency of tests and inspections needed to protect workers from exposure to any identified hazard (e.g. atmosphere - explosive gases, oxygen levels, toxic gases) and ensure the tests and inspections are completed as appropriate.

MONITORING ACCURATELY IS EXTREMELY IMPORTANT - WORKERS LIVES DEPEND ON IT

Only workers who have received training and are considered qualified to use the monitoring equipment will carry out such monitoring. The training mentioned must include instrument calibration, equipment maintenance, and proper interpretation of instrument readings and warning signals.

All monitoring equipment must be serviced, maintained and calibrated to ensure it is working properly before each use. Maintain service logbooks for each piece of confined entry monitoring and testing equipment. An example is found in Appendix C.



You will find a listing of allowable occupational exposure limits to various substances in a current edition of *Threshold Limit Values and Biological Indices*, a publication prepared by the American Conference of Governmental Industrial Hygienists.

If you do not know all airborne (breathing) hazards, then workers entering confined spaces must wear approved pressure-demand, supplied air breathing apparatus, and use continuous monitoring equipment for explosive atmospheres (Fig.13). The atmosphere should not be more than 10 per cent of the lower explosive limit. **Do not permit entry if concentrations of flammables or explosives cannot be reduced to less that 10 per cent of the lower explosive limit**

Ventilation and Purging/Inert

a) Ventilation - a method of forcing air into a confined space near the bottom using a mechanical device. Do this if hazard/risk assessment and monitoring indicates the confined space has a hazardous atmosphere and there is a need for continuous ventilation to maintain a safe atmosphere. A competent person must continuously monitor the atmosphere and re-test after ventilating the space for an appropriate time and before any worker enters.

b) Purging - a method of removing contaminants from a confined space by using liquids (water) or by non-flammable gases (carbon dioxide or nitrogen).

c) Inert – refers to the process of introducing a substance, usually a gas, to make the contaminants non-reactive.

Specific Requirements before Entering a Confined Space:

a) There must be safe ways in and out of all accessible parts of the confined space.

b) The structural integrity of the confined space must be maintained when there are alterations to its physical characteristics to ensure safe entry and exit.

c) A competent worker who is experienced and trained in all aspects of confined space entry work must be present to supervise workers who are in confined spaces and shall be responsible for all work and rescue procedures at all times.

d) An appropriate number of standby workers trained in first aid (CPR) and rescue procedures must be in attendance and continuously monitor workers in the confined space. At all times, the standby worker must be prepared and be appropriately equipped to carry out a rescue. When entry to the space is from the top, at least two stand-by workers are recommended.

e) The worksite must have a communication system capable of reaching an outside rescue agency. Make the outside rescue agency familiar with the workplace and working procedures.

f) A communication system must be in place between the worker in the confined space and the standby worker. This may be visual, two-way radios or wired communications.

g) Take measures to ensure workers will be not be exposed to a risk of drowning or becoming trapped in any liquid or free flowing solid present in the confined space.

h) Identify all energy sources that present a hazard to a worker entering, occupying, or leaving the confined space and put them into a zero energy state.

i) Barricades and warning signs must be used to keep vehicles and pedestrian traffic away from an active confined work space.

j) Fire Safety - where potential for fire and explosion exists, eliminate all ignition sources. Compressed gas cylinders shall not be taken into a confined space (this does not apply to breathing air cylinders). Welding and cutting hoses shall be brought in only for the immediate use and shall be removed immediately after use. Adequate fire fighting equipment shall be readily available. Use special non-sparking (non-ferrous) tools where necessary.

Electrical Safety

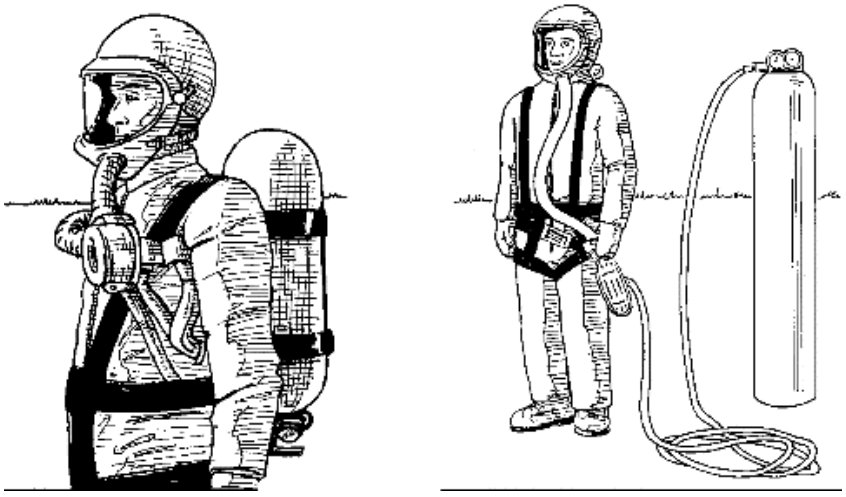
Lights and other electrical equipment must meet the requirements of *The Electricians Licence Act* and *The Manitoba Electrical Code*. Use ground fault interrupters (GFI) as additional protection for operators of electrical equipment, especially when water or other liquids are present.

Safety Provisions and Equipment for Confined Space Work

A worker entering a confined space shall be equipped with all safety apparatus, testing and monitoring equipment relative to the hazard/risk assessment for that confined space.

a) Supplied air breathing apparatus - If hazard/risk assessment recognizes a need for breathing apparatus,(e.g. the concentration of an airborne substance meets or exceeds the occupational exposure limit), only two types may be used in confined spaces. Both are supplied-air pressure, demand type (refer to the most recent edition of *CSA standard Z94.4 – M*). Entry into confined spaces using breathing apparatus must also include continuous explosive atmospheric monitoring. Supplied breathing air must meet the purity requirements set out in the most recent edition of *CSA standard Z180.1 Compressed Breathing Air and Systems*.

b) Self-contained breathing apparatus (SCBA) - Self-contained breathing apparatus provides complete respiratory protection in atmospheres containing toxic/harmful airborne substances where there is an oxygen deficiency. The wearer is independent of the surrounding atmosphere because the breathing system admits no contaminated air into the breathing zone of the wearer.



i) Air line respirator - This is a variation of the self-contained breathing apparatus. The air line replaces the back-mounted tank and provides a source of breathing air. While this apparatus is lighter to wear, the length of the hose will limit the user's movements. You must use an escape bottle with this type of apparatus to provide an emergency supply of air. If a compressor is used, it must be an approved type.

c) Full body harness with lifeline - The worker required to enter the confined space must wear an acceptable full body harness attached to a lifeline that is attached to a personal hoisting device that will facilitate rescue through a narrow opening. The lifeline cable must be a minimum of 3/16 - inch wire rope or other acceptable rigging, capable of a 10 to one safety factor. There may be a provision for alternate safe methods of access and egress where the use of a full body harness and lifeline would create an additional hazard or would not be reasonably practicable.

d) Hoist/retrieval system - All hoisting components shall be capable of supporting a worker with a four-to-one safety factor. All hoists must be equipped with an adequate brake mechanism that allows for immediate fall arrest. The hoisting mechanism must be capable of immediate retrieval of the worker at all times. Any retrieval system must be capable of removing a worker within two and one-half minutes or less. An engineer must approve all shop-fabricated hoists.

e) Personal protective equipment - Proper assessment of conditions and work process should identify additional personal protective equipment necessary for the task to be undertaken. The possibility of personal exposure to toxic substances and traumatic injury requires the consideration of full body protection.

- **If you can not fully assess the risks;**
- **If you can not monitor or test the atmosphere for harmful substances**
- **If you do not have continuous explosive gas monitors and breathing apparatus:**

DO NOT ENTER

Contact the Workplace Safety and Health Division for more information:

Winnipeg:	945-3446 (24 hour)
toll free:	1-800-282-8069
client services:	945-6848
Brandon:	726-6361
Thompson:	677-6821
Flin Flon:	687-1618

Appendix "A"
CONFINED SPACE WORK AREAS

CONFINED SPACE	PRECAUTIONS

Appendix "B"

CONFINED SPACE ENTRY **SAMPLE PERMIT**

Location of work: _____

Description of work (trades): _____

Employees assigned: _____

Entry date: _____ Entry time: _____

Outside contractors: _____

Isolation checklist:

- blanking and/or disconnecting
- electrical
- mechanical
- other

Hazardous work:

- burning
- welding
- brazing
- open flame
- other

Hazards expected:

- corrosive materials
- hot equipment
- flammable materials
- toxic materials
- drains open
- cleaning (e.g. chemical or water lance)
- spark producing operations
- spilled liquids
- pressure systems
- other

Vessel cleaned:

deposits _____
method _____
inspection _____
neutralized with _____

Fire safety precautions: _____

_____

Personal safety:

- ventilation requirements
- respirators
- clothing
- head, hand, foot protection
- shields
- life lines and harnesses
- atmospheric gas tests
- communications
- employee qualified
- buddy system
- stand-by person
- emergency egress procedures
- training sign off (supervisor or qualified person) _____

Test Performed: Location: Reading:

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

Remarks:

_____

Test performed by: _____
Signature

Time: _____

Authorizations:

Supervisor: _____

Production Supervisor: _____

Line Supervisor: _____

Safety Supervisor: _____

Other: _____

Entry and emergency procedures understood:

Stand-by worker: _____
Rescue: _____
Telephone: _____

Permit expires: _____

Classification: _____

Appendix "C"

Monitoring Equipment Log

1. Make_____

2. Model number_____Serial number_____

3. Type of monitor_____

4. Date of purchase_____

Date calibrated_____Calibrated by_____

_____

_____

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