

# Confined Space Program

*Occupational Health & Safety*

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**ALGONQUIN**  
COLLEGE

## **CONTENTS**

Introduction	1
Special features & Hazards	6
Equipment	11
Confined space classification	13
Confined space - TYPE 1	
Confined space - TYPE 2	
Confined space - TYPE 3	
Procedures for confined space entry	14
Specific Work procedures	18
Rescue and emergency response	23
Training	25
Permits and checklists	26
Appendix A – Confined Space Inventory	

## **INTRODUCTION**

Working in confined spaces is considered to be dangerous work which requires training, knowledge, special skills, accurate hazard assessment and well trained rescuers.

Workers entering and working in confined spaces often recognize the hazards when it's too late. There are many hazards in confined spaces which can result in serious injuries and death. More than 60 percent of those who die in confined spaces are untrained workers. They all have good intentions in attempting to rescue other workers and in the process not only fail to save the life of a co-worker but also get killed in the operation.

The Occupational Health and Safety Act of Ontario and the Regulations for Industrial Establishments and Construction give clear direction for the entry and working in confined spaces. The College recognizes these requirements as the minimum to be followed when entering and working in confined spaces.

The information contained in this package is intended to serve as the accepted practice for all work done in confined spaces at the College. All persons (College employees and contractors) entering and working in confined spaces must be knowledgeable about the information and follow the procedures contained in this package.

***Departments undertaking work in confined spaces are responsible for implementing this program effectively in their operations.***

## **SCOPE**

This program applies to all persons, College workers and contractors, engaged in activities related to confined spaces and confined space entry. Confined space entry procedures that have been developed by contract companies or other non-college parties who are engaged in work activities at the College may be substituted for these procedures if the work does not involve College staff and the procedures provide for equivalent protection of the workers involved.

This program also applies to work or activities that are of a routine or planned nature as well as non-routine and emergency type operations in confined spaces.

Only competent College workers and competent contractors may enter a confined space after all regulatory and College program requirements have been complied with.

## **REGULATION** (OHS – Industrial Establishments Reg. 851 / 90)

***Confined Space:*** a space in which, because of its construction, location, contents or work activity therein, the accumulation of a hazardous gas, vapour, dust or fume or the creation of an oxygen-deficient atmosphere may occur;

## ***EXCERPT***

67. The requirements of sections 68, 69, 70 and 71 apply, with all necessary modifications, to any confined space while a worker is in that space. R.R.O. 1990, Reg. 851, s. 67.

68. Subject to section 70, a confined space shall be entered only where,
- (a) there is an easy egress from all accessible parts of the confined space;
  - (b) mechanical equipment in the confined space is,
    - (i) disconnected from its power source, and
    - (ii) locked out;
  - (c) all pipes and other supply lines whose contents are likely to create a hazard are blanked off; and
  - (d) the confined space is tested and evaluated by a competent person who,
    - (i) records the results of each test in a permanent record, and
    - (ii) certifies in writing in the permanent record that the confined space,
      - (A) is free from hazard, and
      - (B) will remain free from hazard while any worker is in the confined space having regard to the nature and duration of the work to be performed. R.R.O. 1990, Reg. 851, s. 68.
69. Subject to section 70, a confined space in which there exists or is likely to exist,
- (a) hazardous gas, vapour, dust or fume; or
  - (b) an oxygen content of less than 18 per cent or more than 23 per cent at atmospheric pressure, shall be entered only when,
    - (c) the requirements of section 68 are complied with;
    - (d) the space is purged and ventilated to provide a safe atmosphere;
    - (e) the measures necessary to maintain a safe atmosphere have been taken;
    - (f) another worker is stationed outside the confined space;
    - (g) suitable arrangements have been made to remove the worker from the confined space should the worker require assistance; and
    - (h) a person adequately trained in artificial respiration is conveniently available. R.R.O. 1990, Reg. 851, s. 69.
70. A confined space in which there exists or is likely to exist,
- (a) a hazardous gas, vapour, dust or fume; or
  - (b) an oxygen content of less than 18 per cent or more than 23 per cent at atmospheric pressure, and that cannot be purged and ventilated to provide and maintain a safe atmosphere shall be entered only when,
  - (c) all the requirements of section 68 except subclause (d) (ii) are complied with;
  - (d) the worker entering is using a suitable breathing apparatus and a safety harness or other similar equipment to which is securely attached a rope, the free end of which is held by a worker equipped with an alarm who is keeping watch outside the confined space;
  - (e) the worker entering is using such other equipment as is necessary to ensure the worker's safety;
  - (f) the safety harness, rope and other equipment mentioned in clause (d) have been inspected by a competent person and are in good working order; and
  - (g) a person adequately trained in artificial respiration is conveniently available. R.R.O. 1990, Reg. 851, s. 70.
71. (1) Subject to subsection (2), where the gas or vapour in a confined space is or is likely to be explosive or flammable, the confined space shall be entered only where,

(a) the concentration of the gas or vapour does not or is not likely to exceed 50 per cent of the lower explosive limit of the gas or vapour; and

(b) the only work to be performed is that of cleaning or inspecting and of such a nature that it does not create any source of ignition.

(2) Cold work may be performed in a confined space that contains or is likely to contain an explosive or flammable gas or vapour where the concentration does not, and is not likely to exceed 10 per cent of the lower explosive limit of the gas or vapour. R.R.O. 1990, Reg. 851, s. 71.

## **SPECIAL FEATURES OF CONFINED SPACES**

Any space may be considered as a confined space if it has one or more of the following special features

1.
  - (a) the design, location and construction restrict movement.
  - (b) there are limited openings for entering and exiting the space.
  - (c) inside configurations which get smaller or have sloping floors and sides and which may likely trap a person inside.
  - (d) containing materials, either liquids or solids which can move and engulf or trap a person.
  - (e) containing other known serious safety hazards.
  - (f) not used for continuous occupancy.
  - (g) containing an oxygen deficient atmosphere; less than 18% oxygen.
  - (h) containing an oxygen enriched atmosphere; more than 23% oxygen.
  - (i) contents or work activities may result in the accumulation of hazardous gas, vapour, dust and fume.

## **EXAMPLES OF CONFINED SPACES**

### INDUSTRIAL PROJECTS AND CONSTRUCTION

Sumps, pits, digesters, mixers, bins, flutes, ducts, conveyors, elevators, trenches, tunnels, wells, tanks, pressure vessels, boilers, vaults, basements, unventilated rooms, areas containing Ammonia or Chlorine and others.

### SEWER SYSTEMS

Pipes, sewers, manholes, settling tanks, pumping areas, digesters, holding tanks, cisterns and others.

## **HAZARDS**

A hazard is a condition or set of circumstances which has the potential to adversely affect the health of a worker through injury or illness. The confined space environment presents many unique hazards as well as hazards which are common to all workplaces. A thorough understanding of these hazards and the acceptable precautions when used diligently can make the difference between life and death.

### **1. ATMOSPHERIC HAZARDS**

#### OXYGEN DEFICIENCY

Oxygen deficiency is the most common hazard found in confined spaces. This situation arises as a result of no air circulation or the depletion of the oxygen within the space. Some of the causes are;

### Metal Oxidation or Rusting

During the process of oxidation the oxygen in the air is used up as it reacts with metals. Most commonly rust formation is accelerated in spaces containing iron and moisture.

### Bacterial Action or Mold and Fungus growth

The growth of molds and fungi require large amounts of oxygen as a result the limited oxygen in the confined space is used by the organism. This condition is usually found in sewage and landfills.

### Combustion

Combustion is the rapid oxidation of a substance through burning. Fires in confined spaces use up the oxygen and dangerously low levels of oxygen are present long after the fire is extinguished.

### Oxygen Displacement

There are many gases which take the place of oxygen. For example, Nitrogen, which is not dangerous to the body by itself, however it may displace sufficient oxygen to make the atmosphere in confined spaces oxygen deficient.

The following table shows the effects of oxygen deficiency on the human body:

OXYGEN LEVELS	SYMPTOMS	EFFECTS
23 - 100%	NONE	HIGH RISK OF FLAMMABILITY OXYGEN POISONING
18 - 23%	NONE	NORMAL BREATHING AIR
12 - 16%	FASTER PULSE RATE	LACK OF FINE COORDINATION IN FINGERS AND HANDS
10 - 12%	RAPID PULSE NAUSEA, HEADACHE	BREATHING DIFFICULTY LACK OF COORDINATION
6 - 10%	ACUTE LETHARGY	NO COORDINATION INABILITY TO REACT LOSS OF CONSCIOUSNESS
0 - 6%		DEATH

### OXYGEN ENRICHMENT

The main danger from an area which has become oxygen enriched is the increased possibility for spontaneous combustion and explosion. As the amount of oxygen in the air is increased some oils, dust on hair or clothing may react and burn. An ignition source in the areas may result in rapid fire spread and explosion.

#### COMBUSTIBLE GASES AND VAPOURS

Combustible gases and vapours may be present within a confined space. Depending on the properties of the gases or vapours, they may travel easily and fill the space. Some gases may be lighter than air and will rise while other gases are heavier than air and will sink to low areas in the space. The proper mixture of combustible gases and vapours along with an ignition source will result in fires.

#### TOXIC GASES, VAPOURS, DUST OR FUMES

The air in the confined space may have poisonous gases, vapours, dusts and fumes. These at known concentration will cause severe illnesses and death. The concentration of toxic materials must not be greater than the permissible exposure limits.

Some of the commonly known toxic substances in confined spaces are:

##### CARBON MONOXIDE

A colourless, odourless gas generated by combustion. Carbon monoxide replaces oxygen in the blood causing asphyxiation.

##### CARBON DIOXIDE

Carbon dioxide is also a colourless, odourless gas which causes suffocation by displacing oxygen from the lungs. It will also cause headache, dizziness, shortness of breath, muscle weakness, drowsiness and ringing in the ears.

##### METHANE

Methane is a colourless, odourless gas which is highly flammable. Along with fire and explosion hazards, it displaces oxygen and will cause suffocation.

##### CHLORINE

A heavy greenish-yellow gas with a pungent odour. At low concentration Chlorine will destroy lung tissue.

##### AMMONIA

Ammonia causes death as a result of bronchial spasm.

##### ASBESTOS

Asbestos fibers cause damage to the lung tissue and may cause lung cancer.

##### GASOLINE

The distinctive smell of gasoline is usually lost as it travels underground. Gasoline vapours are toxic while at the same time being flammable.

## HYDROGEN SULFIDE

A short exposure to this gas at low concentration can cause unconsciousness and death. It smells like rotten eggs at low concentration. It is also extremely flammable and highly explosive.

## SULPHUR DIOXIDE

A colourless gas with a strong suffocation odour. Exposure to the high concentration will cause irritation to the respiratory system causing difficulty in breathing and death.

## NITROGEN DIOXIDE

A reddish-brown gas or a yellow liquid which becomes colourless at 11.2 degrees C. Exposure is very dangerous. As it enters the respiratory tract it causes minor irritation to the nose and throat. In the lungs it reacts with water to form acids and alkalis.

## **2. FIRE AND EXPLOSION HAZARDS**

Fires and/or explosions are extremely dangerous in confined spaces due to restricted exit and the ability to move freely inside the space. Fire and explosions are caused by the materials found inside the confined spaces and also by the work activity being done.

## **3. ENTRY AND EXIT HAZARDS**

Openings to confined spaces are usually small, narrow and are generally difficult to get in and out, especially in cases of emergency. Injuries to the body can be sustained while entering or exiting a confined space. The actual opening of the confined space such as lifting a manhole cover usually poses a hazard.

## **4. CONTENTS**

The contents and the materials found inside a space can become hazardous. Pipes and structures when damaged and ruptured create life threatening conditions.

## **5. BULK MATERIAL SHIFTING**

Grains, fertilizers and landfills have a tendency to shift and engulf workers.

## **6. SURFACES**

Working and walking surfaces can be slippery, irregular, obstructed and constructed at an angle. These surfaces usually result in a tripping and falling hazards.

## **7. TEMPERATURE EXTREMES**

Prolonged exposure to high temperatures may cause heat cramps, heat exhaustion, dehydration and heat stroke, while exposure to extreme cold temperature can cause frostbite and hypothermia.

## **8. MECHANICAL EQUIPMENT**

Equipment in confined spaces have many moving parts generating energy and force. These include augers, agitators, mixer blades etc. The inadvertent operation of these types of equipment poses many hazards for workers in confined spaces.

**9. ELECTRICAL SHOCK**

Confined spaces which have electrical power equipment of high voltages and work which requires the use of electrical power tools or welding equipment can result in workers being electrocuted.

**10. NOISE**

Regular sounds are amplified in confined spaces and can result in severe hearing loss. Noise will make communication between workers as well as rescue operations difficult.

**11. VISIBILITY**

Confined spaces usually do not have fixed lighting. Working with inadequate lighting can result in injuries like bumps and cuts. Eye strains become very frequent and rescue operation is hindered.

**12. PSYCHOLOGICAL FACTORS**

Working in restricted areas can cause disorientation and claustrophobia. Workers who fear enclosures are likely to panic and cause injury to themselves and possibly others.

## **EQUIPMENT**

As we understand the degree of risk involved while working in confined spaces, we also recognize the need to know the exact conditions which may be present each time we enter a confined space. The Occupational Health and Safety Act and Regulations require that atmospheric testing be done before entry into confined spaces. Along with the work equipment other specific equipment must be available for entry into confined spaces. This equipment is divided into three types. They are; atmospheric testing, ventilation and personal protective equipment.

### **ATMOSPHERIC TESTING: Methods and Equipment**

#### **OXYGEN LEVEL TEST**

Normal fresh air has 21 percent oxygen. Air in a confined space is hazardous if the oxygen level is less than 18 percent or more than 23 percent. This program adopts ACGIH levels of 19.5 % and lower as being hazardous.

#### **FLAMMABILITY TEST**

The air in a confined space is hazardous if the concentration of flammable gas, vapour or fumes within, exceeds 10 percent of the lower explosive limit (LEL). The flammability test is always performed after the oxygen test.

#### **TOXICITY TEST**

There are many known toxic gases, vapours and fumes likely to be found in confined spaces. These are to be tested before anyone enters and works in confined spaces. These are described previously in this program under the topic 'Hazards'.

The instruments used at Algonquin College for testing oxygen and flammability levels are the MSA Microgard Oxygen LEL Meter and the Industrial Scientific TMX 410 Meter. The H-NU PI-101 Photo-ionization Detector can be used to test for toxicity.

### **VENTILATION EQUIPMENT**

As mentioned before confined spaces are known to have toxic gases and the main control method is to ventilate the area by replacing the unsafe air with clean air. Fans and collapsible ducts are used to provide the air movement required in confined spaces.

Confined spaces are ventilated when the confined space contains air which has too little oxygen, too much oxygen, flammable and/or toxic gases. The ventilation equipment must provide a minimum of 10 air changes per hour in the confined space.

The College has two Axial Blower Units with 8"- 20 foot long flexible hose. The first is capable of delivering in excess of 450 cfm, the second in excess of 800 cfm.

### **PERSONAL PROTECTIVE EQUIPMENT**

Personal protective equipment is used by workers when other control methods of reducing the hazards are either insufficient or the concentration of the toxic substances are unknown.

Entering and working in confined spaces requires appropriate respiratory protection.

Considering the confined space environment, that is one of oxygen deficiency and toxic gases, the proper type of respirator is one containing supplied air. This could be either a line type or self contained breathing apparatus (SCBA)

The College has MSA low pressure Ultra Lite Mask with 1/2 hour bottles.

### **OTHER PERSONAL PROTECTIVE EQUIPMENT**

While emphasis is placed on the hazards of confined spaces, one should not lose sight of the other hazards present in the work area. Other personal protective equipment must be used when working in and about confined spaces. These include Head protection, Eye protection, Hearing protection, other Breathing protection, Foot protection and others as the tasks may require.

For Type 2 and Type 3 confined spaces, a Personal Alert Safety System (person down alarm) must be worn by the worker entering those spaces.

### **RESCUE EQUIPMENT**

The legislation and acceptable work practices require the provision for rescue and emergency response to be available when confined space entry and work are undertaken.

The rescue and emergency response plan must be able to evacuate an unconscious or disabled worker from outside the confined space.

The plan must include:

1. Adequate numbers of trained personnel outside the confined space to rescue a disabled worker.
2. Mechanical system to assist in the retrieval of a disabled worker.
3. Alarm and communication system to summon help.
4. Workers outside the confined space who are trained in first-aid and cardio-pulmonary resuscitation.

### **CLASSIFICATION OF CONFINED SPACES**

The work activities at the College which require entry and working in confined spaces are varied. In order to meet the requirement of the legislation and at the same time provide adequate protection for all workers, the College has divided confined spaces into three types.

These are:

- CONFINED SPACE - TYPE 1
- CONFINED SPACE - TYPE 2

## CONFINED SPACE - TYPE 3

### CONFINED SPACE - TYPE 1

Confined space - Type one refers to any space for which the means of access or egress and the inside are restricted because of location, design and construction. These spaces should have adequate ventilation.

The following are examples of confined space - Type 1:

Ceiling plenum and ventilation ducts, open boilers, ventilated shafts and tunnels.

### CONFINED SPACE - TYPE 2

Confined space - Type 2 refers to all spaces covered in the definition which contain or are likely to contain an oxygen deficient atmosphere. These spaces are usually enclosed but the content and activity are highly unlikely to contain either flammable or toxic gases.

The following are examples of confined space - Type 2:

Unventilated crawl spaces under buildings and open and closed unventilated pits.

### CONFINED SPACE - TYPE 3

Confined space - Type 3 are all confined spaces covered by the legislation and are likely to have any of the hazards listed previously in the package.

The following are examples of confined space -Type 3:

Sewers, closed boilers, tanks and crawl space under labs and shops containing hazardous materials.

***Inventories have been conducted for the Woodroffe and the Rideau Campuses. See Appendix A.***

## **PROCEDURES FOR CONFINED SPACE ENTRY**

Confined space entry in the College and in other work places presents many possible hazards due to the nature of the space and the contaminants likely to be in the atmosphere.

A comprehensive approach to entries and work is essential to ensure the safety of workers. The following sequence is the checklist to be followed and addressed prior to entry and work in confined spaces:

1. JOB PRE -PLANNING
2. INSPECTION OF EQUIPMENT
3. SITE CONTROL, IF NECESSARY
4. TESTING FOR ATMOSPHERIC HAZARDS
5. RECORDING OF TEST RESULTS
6. OPENING OF CONFINED SPACE
7. PURGING OR VENTILATING, IF NECESSARY
8. RE-TESTING FOR ATMOSPHERIC HAZARDS
9. RECORDING OF TEST RESULTS
10. SETTING-UP FOR RESCUE AND EMERGENCY RESPONSE
11. ENTERING OF CONFINED SPACE
12. PERFORMING WORK
13. CLOSURE OF CONFINED SPACE
14. STORAGE OF EQUIPMENT

## **1. JOB PRE-PLANNING**

The hazards in confined spaces may be sudden and severe. As a result thorough planning should be done for all entry and work in confined spaces. Supervisors should determine the type of confined space and the procedures to be followed. Work assignments should be given at least one day in advance.

## **2. INSPECTION OF EQUIPMENT**

All the equipment used in confined spaces is usually kept in storage and should be inspected to ensure that it is in good operating condition when the job is assigned. Testing instruments should be checked to ensure that the batteries are fully charged, that the instruments are calibrated and are working properly.

## **3. SITE CONTROL**

There is constant movement of people in the College which require the worksite to be controlled. Signs and barriers should be installed to warn others of the work in progress and at the same time prevent anyone from unknowingly endangering themselves or the workers in the confined space.

If the confined space is outdoors or where vehicular traffic is present, then all requirements for traffic control should be followed.

## **4. TESTING FOR ATMOSPHERIC HAZARDS**

Testing for atmospheric hazards must be done by a competent person who is trained in the use of the instruments and the interpretation of the results. All sections of a vertical space should be tested. (see sections on Atmospheric testing methods and equipment and other training material). Entry into the confined space will be done only when the test results indicate safe levels. Testing must also be done to ensure that the space remains free from hazards during the entire work period.

## **5. RECORDING OF TEST RESULTS**

A permanent record must be kept of all test results. The confined space entry permit used by the College is adequate and should be completed and filed.

## **6. OPENING OF CONFINED SPACE**

The opening of confined spaces should be done with the correct tools and procedures without causing any injuries. Special precautions should be used for removing the covers of manholes to avoid back injuries and sparks.

## **7. PURGING OR VENTILATING, IF NECESSARY**

Confined spaces are ventilated when the confined space contains air which has too little oxygen, too much oxygen, flammable or toxic gases. The ventilation equipment must provide a minimum of 10 air changes per hour in the confined space. In most cases the ventilation for confined spaces at the College is achieved by using a blower fan unit.

Specialized equipment must be used for atmospheric conditions which have flammable gases and additional ventilation should be considered for such activities as hot work.

These should be used in consultation with the Coordinator OHS.

#### **8. RE-TESTING FOR ATMOSPHERIC HAZARDS**

Same as testing for atmospheric hazards.

#### **9. RECORDING OF TEST RESULTS**

Same as stated above.

#### **10. SETTING UP FOR RESCUE AND EMERGENCY RESPONSE**

The setting up for rescue and emergency is mandatory for Confined Spaces - Type 3. A harness and a life line may also be required for certain Type 1 and Type 2 work. Only persons trained for rescue and emergency operations may undertake these type of entries.

#### **11. ENTERING OF CONFINED SPACE**

Confined spaces should be entered only when it is safe to do so.

#### **12. PERFORMING WORK**

The assigned work in the confined space should be done without delay and with the appropriate tools and safety equipment. Where necessary, other permits such as lock-out and hot work will be used and all necessary precautions will be used in order to minimize other hazards or to maintain an atmosphere free from contamination.

#### **13. CLOSURE OF CONFINED SPACE**

Although this may sound very trivial, there are many situations in the College where confined spaces entrances were left open after the work was completed. If the work assigned continues beyond a break period or into another shift the entrance should be temporarily closed. If this is not practical then the appropriate signs and barriers should be installed.

#### **14. STORAGE AND MAINTENANCE OF EQUIPMENT**

The testing instruments are very sensitive, while the rescue equipment can be damaged easily. Proper storage and maintenance will ensure that these instruments and equipment are always in good working condition when needed. The College has appropriate storage facilities and these should be used.

## **SPECIFIC WORK PROCEDURES**

### ***CONFINED SPACE - TYPE 1***

Confined space - Type 1 refers to any space for which the means of access or egress and the inside are restricted because of location, design and construction. These spaces should have adequate ventilation.

The following are examples of Confined Space - Type 1: Ceiling plenum and ventilation ducts, open boilers, ventilated shafts and tunnels.

1. Supervisors will assign work in Confined Space Type 1 to at least two workers with a minimum of one day's notice. A Confined Space - Type 1 Entry Permit will be issued by the supervisor.
2. Supervisors and/or workers will inspect the instruments and equipment to be used for the job. The checklist in the Confined Space Entry Permit must be used.
3. Workers will place a notice and install barriers if required to secure the entrances to the confined space.
4. Testing shall be conducted prior to opening the access hatch. If it is safe to do so, the space shall be opened and an oxygen test will be conducted by a competent worker.
5. The test results will be recorded on the Confined Space Entry Permit. If the results indicate good ventilation (21 % Oxygen), the worker will enter the space and perform the assigned task. The time of entry and exit must be entered on the permit.
6. The permit will be posted near the entrance to the confined space.
7. Workers will close all entrances of the confined space, store the oxygen testing instrument appropriately and return the completed Confined Space Entry Permit to the supervisor.
8. Supervisors will review the information on the Confined Space Entry Permit, take appropriate action as necessary. The permit will be filed permanently and kept for at least two years.
9. The supervisor will log the entry, indicating the date and times of entry, space entered, reason for entry and note observations related to the entry.

**IMPORTANT:** If hotwork is being undertaken in the space a hotwork permit will be required. Ventilation equipment must be used. If electrical / mechanical work is being undertaken the provisions of the lock-out / tag-out program must be applied.

## **CONFINED SPACE - TYPE 2**

Confined space - Type two refers to all spaces covered in the definition which contain or likely to contain an oxygen deficient atmosphere. These spaces are usually enclosed but the content and activity are unlikely to contain either flammable or toxic gases.

The following are examples of confined space Type 2: Unventilated crawl spaces under buildings and open and closed unventilated pits.

1. Supervisors will assign work in Confined Space Type 2 to at least two workers a minimum of one day notice in advance. A Confined Space Type 2-3 Entry Permit will be issued by the supervisor.
2. Supervisors and/or workers will inspect the instruments and equipment to be used for the job. The checklist in the Confined Space Entry Permit must be used.
3. Workers will place a notice and install barriers if required to secure the entrances to the Confined space.
4. Testing shall be conducted prior to opening the access to the confined space. If it is safe to do so, the space shall be opened and an oxygen testing will be taken by a competent worker.

The test results will be recorded on the Confined Space Entry Permit.

5. If the test results indicate an oxygen deficient atmosphere, less than 19.5%, the space will be purged with fresh air for at least 20 minutes.
6. The competent workers will conduct a second oxygen test and record the result on the permit. Purging of the space and testing will be repeated until safe oxygen levels are obtained.
7. The permit will be posted near the entrance to the confined space.
8. Only when the oxygen tests indicate safe levels (between 19.5% to 23% ) may a worker enter the space and perform the assigned task. The other worker must remain outside at all times to ensure that the ventilation equipment maintains a safe atmosphere and provides assistance to the worker inside in case of emergency or call for help.

The time of entry and exit must be recorded on the permit.

9. Workers will close all entrances to the confined space, store the oxygen testing instrument and other equipment appropriately and return the Confined Space Entry Permit to the supervisor.
10. Supervisors will review the information on the Confined Space Entry Permit and take appropriate action as necessary. The permit will be filed permanently and kept for at least two years.

11. The supervisor will log the entry, indicating the date and times of entry, space entered, reason for entry and note observations related to the entry.

**IMPORTANT:** If hotwork is being undertaken in the space a hotwork permit will be required. Ventilation equipment must be used. If electrical / mechanical work is being undertaken the provisions of the lock-out / tag-out program must be applied.

### **CONFINED SPACE - TYPE 3**

Confined space - Type 3 are all confined spaces covered by the legislation and are likely to have some or all the hazards listed previously in the package.

The following are examples of confined space -Type 3: Sewers, closed boilers, tanks and crawl space under labs and shops containing hazardous materials.

1. Supervisors will assign work in Confined Space Type 3 to at least two workers a minimum of one day in advance. A Confined Space Type 2-3 Entry Permit will be issued by the supervisor.

The supervisor will notify the Coordinator OHS and the certified members at least one day in advance of work to be undertaken in a type 3 space.

2. Supervisors and/or workers will inspect the instruments and equipment to be used for the job. The checklist in the Confined Space Entry Permit must be used. Rescue and emergency equipment will be considered as equipment to be used for the job and will be included on the permit.
3. Workers will place a notice and install barriers to secure the entrances to the Confined space. If necessary vehicular traffic control should be established.
4. An atmospheric test around the opening will be taken and recorded. Tests will be taken for oxygen levels, flammable and toxic gases.
5. The rescue and emergency equipment will be installed and tested for efficient operation.
6. The space will be opened and an oxygen test will be taken by the competent workers at varying levels inside the space.  
  
The test results will be recorded on the Confined Space Entry Permit.
7. If the test results indicate an oxygen deficient atmosphere, the space will be purged with fresh air for at least 20 minutes.
8. The competent worker will conduct a second oxygen test and record the result on the permit. Purging of the space and testing will be repeated until safe oxygen levels are obtained (19.5 % to 23% oxygen).
9. The permit will be posted near the entrance to the confined space.
10. Flammability and toxicity tests will be taken and recorded in the Confined Space Entry Permit.
11. Workers assigned to enter the confined space will wear a full harness and a life line, if practicable.

12. Only when the atmospheric tests indicate safe levels may a worker enter the space and establish adequate extraction of hazardous gases which may be produced as a result of the work e.g. hot work. The other worker will ensure that the ventilation equipment maintains a safe atmosphere and the rescue and emergency equipment is laid out for a quick and effective response.
13. Only when the ventilation system inside the space and the rescue and emergency system outside are ready and operating, may the assigned worker enter the space and perform the task planned.  
  
The time of entry and exit must be entered on the permit.
14. The space will be continuously monitored to ensure that the atmosphere is free from hazards. The results will be recorded every 15 minutes on the permit.
15. When the work is completed, workers will close all entrances to the confined space, store all testing instruments emergency and other equipment appropriately and return the Confined Space Entry Permit to the supervisor.
16. Supervisors will review the information on the Confined Space Entry Permit and take appropriate action as necessary. The permit will be filed permanently and kept for at least two years.
17. The supervisor will log the entry, indicating the date and times of entry, space entered, reason for entry and note observations related to the entry.

## **RESCUE AND EMERGENCY RESPONSE**

The hazards related to confined spaces can overpower a worker suddenly and in most cases disable and leave the person unconscious. This gives a sense of urgency to those who are nearby. Too many people have died because they, with all good intention have gone to rescue a co-worker unprotected, unprepared and untrained.

Providing a rescue team whose members are well trained and can respond quickly is a responsibility of all employers, especially where workers are required to work in confined spaces.

This section of the package outlines the requirements and procedures to be followed when preparing for confined space rescue and emergency response.

### **TEAM MEMBERS**

Competent persons trained in confined space entry, SCBA use, first-aid, CPR, and rescue procedures.

### **HAZARD RECOGNITION**

The members of the rescue and emergency team must be able to identify the hazards likely to be found in confined spaces. These are found in the section on hazards in this package.

### **PERSONAL PROTECTIVE EQUIPMENT**

Each team member has to be outfitted with all the protective equipment suitable for the hazards in the confined space. These will include helmets, full bodied suit, safety boots, gloves and self contained breathing apparatus (SCBA).

### **MECHANICAL RETRIEVING DEVICE**

Wherever practical, the rescue operation should be done from the outside. To achieve this effectively the use of mechanical retrieving devices are recommended.

A system of ropes and pulleys can increase the advantage to rescue people safely and effectively.

### **ROPES**

Ropes used for rescue operation come in different sizes and strength and must meet CSA specifications. The way in which ropes are used, stored, cared and inspected can well determine the success or failure of a rescue attempt.

It is also important to note that rope materials may be subject to damage from moisture, abrasion and chemicals. It is important that the rope material be suitable for the task at hand.

The use of ropes depends on the ability of rescuers to tie knots which are appropriate for the operation.

## **COMMUNICATION**

Fast and effective communication helps in getting the appropriate resources to the scene. This enables effective rescue and speedy transport to medical treatment. In many cases this can be the difference between life and death.

The legislation requires that an alarm be placed at the entrance of the confined space. This is used only to indicate that an emergency is in progress. Effective communication can be achieved by using radios and telephone to communicate and to request further assistance. In the Ottawa region 911 can give further assistance.

## **FIRST AID**

Artificial Respiration and Cardio-Pulmonary Resuscitation (CPR) are either included in the training program or are pre-requirements for the team membership. Along with standard first aid, rescuers should be able to identify additional signs and symptoms relating to chemical exposure and work related hazards. Casualty immobilization and transport are important skills used during rescue operation. Special attention should be given to vertical lift out of confined spaces.

## **TRAINING AND DRILLS**

The training requirement for the Confined Space rescue team is very comprehensive.

Each member needs to be thoroughly familiar with the hazards and work practices involved with entry and working in confined spaces. In other words he or she should be a competent confined space worker. Additional training in the use and maintenance of rescue equipment, communication, first aid and CPR should be included.

There should be at least an annual update and practice.

## **CONFINED SPACE WORKER TRAINING**

In order for workers to fully appreciate the requirements and procedures for working in confined spaces, they must participate in a training program. The program should include the following topics:

- Legislation pertaining to confined spaces.
- Hazards in confined spaces.
- Atmospheric testing instruments
- Personal protective equipment.
- General work procedures for confined spaces.
- Specific procedures for Algonquin College and
- Rescue and emergency response.

Training in the proper use of SCBA

Training in first-aid (standard level) and CPR (BCLS level)

## **CHECKLIST AND PERMITS**

The use of checklist and permits should be used for planning, controlling and evaluating entries and work in confined spaces.

### **GENERAL ENTRY CHECKLIST**

- Date and time of entry.
- Location
- Name of worker
- Atmospheric tests results
- Oxygen
- Flammability
- Toxicity
- Gas detector used
- Description of work to be done
- Tags and Lock out required
- Rescue and emergency equipment

### **RESCUE AND EMERGENCY EQUIPMENT CHECKLIST**

- Safety harness
- Ropes
- Respirators
- Gas detectors
- PPE
- Mechanical retrieval devices
- Ventilator and ducts
- Blankets and stretchers
- Radio and telephone
- Fire extinguishers
- Temporary lighting

### **ADDITIONAL EQUIPMENT**

- Explosion proof lighting
- Explosion proof tools
- Ventilators and ducts
- Respirators
- PPE
- Personal Alarm (PASS) device