

Confined Space Entry Procedures Manual

Mar-Tech Underground Services Ltd.

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REMEMBER:
**FOR ANY CONFINED
SPACE ENTRY**

***FAILURE TO
COMPLY WITH ALL
PROCEDURES
COULD BE FATAL!***

**THERE ARE NO EXCEPTIONS TO THE PROCEDURES
AS DESCRIBED IN THIS MANUAL!**

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CONFINED SPACE ENTRY PROCEDURES

INTRODUCTION

The purpose of this manual is to augment the safety training provided to the worker with written instructions on the various safety aspects of Confined Space Entry (hereafter referred to as CSE). This manual also acts as a reference for new employees who have not yet taken the confined space entry certification training.

It is of the utmost importance that all workers understand the inherent and potential dangers posed to health and safety when working in or near a confined space.

1.0 RESPONSIBILITIES

Below find details regarding the schema employed by Mar-Tech for organization and management of its' CSE Program.

1.1 EMPLOYER

The employer, Mar-Tech Underground Services Ltd., hereafter to be referred to simply as Mar-Tech, is vitally concerned with its employees' health and safety. It is a primary objective of management to protect our workers from injury and illness of all kinds. To this end, as the employer, Mar-Tech will:

1. Provide a statement of policy relating to the safety program.
2. Maintain overall control of the safety and loss prevention program.
3. Ensure that all established safety policies are administered and enforced in all areas.
4. Ensure that all personnel are aware of and effectively practice the policies and procedures set out in the health and safety program.
5. Provide information, instructions, and assistance to all supervisory staff in order to protect the health and safety of all employees.
6. Understand and enforce the accident prevention policy as well as the occupational health and safety legislation.
7. Provide all supervisory staff with proper, well-maintained tools and equipment, plus any special personal protective devices which may be required.
8. Provide ongoing health and safety education programs and approved first aid training courses as required.
9. Monitor departments and projects and hold them accountable for their individual safety performance. Provide for inspection, maintenance and repair of all safety and personal protective equipment as outlined later in this manual as required for safe Confined Space Entry work.
10. Appoint Administrators who are tasked with the job of developing, implementing, maintaining, enforcing and upgrading the CSE Program as needed.
11. Facilitate the manpower and resources for mandatory CSE Training, including formal training and ongoing, practical on-the-job CSE training.

1.2 ADMINISTRATION

Overall administration of Mar-Tech's confined Space Entry (CSE) Program is assigned to Jason Roy, Safety Officer-Mar-Tech Underground Services Ltd.

Administration duties and authority with regards to the CSE Program include:

1. Implementation of the CSE program.

2. Development and facilitation of New Worker Safety Indoctrination Program, including Basic CSE Training.

3. Advise management and employees on:
 - preventing injury and illness to personnel and damage to plant and equipment
 - legal requirements affecting safety, health and welfare
 - provision and use of protective clothing and equipment
 - suitability, from a safety viewpoint, of new equipment, and validity of all appropriate test certificates
 - potential hazards on new contracts before work starts and precautions required
 - changes in legislation

4. Record and analyze information on injuries, illness, damage and production loss.
5. Assess accident trends and review overall safety performances.
6. Maintain contact with regulatory professional bodies.
7. Take part in workplace discussions on injury, health and welfare, damage control.
8. Keep up-to-date with recommended codes of practice and new safety and health literature.
9. Administer safety program.
10. Assist in accident investigations, analysis and preparation of accident reports and summaries.
11. Prepare inspection reports.
12. Ensure that corrective action has been taken whenever deficiencies are identified.
13. Assist with safety seminars or training.

1.3 SUPERVISORS

All confined space entries are to be supervised by an employee who is both experienced and certified and who is appointed to supervise the Confined Space Entry being conducted. For example, as of the writing of the document, Ron Ferenczi is the site supervisor in charge of all CSE for Full length CIPP projects. The Supervisor can and will appoint other certified persons to act as supervisors for Confined Space Entry. Such examples are the operator in charge of a video inspection crew; grout crew, point-repair CIPP, and service reline crew, etc, etc. Each operator-rated employee within Mar-Tech is classified as capable of Supervising CSE but must be verbally appointed to the task. There are no exceptions to these requirements. If there is no-one on-site who is appointed and certified to conduct Confined Space Entries, then the confined space cannot be entered by any worker.

1. Co-operate with health and safety committee members
2. Provide instructions to employees about safe work procedures. As part of the routine duties, the supervisor shall require employees to use personal protective equipment as appropriate.
3. Provide an example for others by always directing and performing work in a safe manner.
4. Conduct regular inspections for unsafe practices and conditions and ensure prompt corrective action.
5. Work in cooperation with others in determining safe practices, enforcing their observance, developing procedures for dealing with violations and general safety and accident prevention.
6. Enforce all established safety regulations and work methods. Take corrective action as necessary to ensure compliance with the rules.
7. Know and apply the workplace safety policy and relevant occupational health and safety legislation.
8. Arrange for medical treatment as required, including transportation to a doctor or hospital as necessary.
9. Report all accidents immediately, investigate all accidents fully, and advise management on how to prevent similar accidents in the future.

10. Carry out regular inspections of the work place to ensure a safe and healthy environment.
11. Hold regular safety meetings to review safety conditions and general safety policies.
12. Accompany the government inspector during project inspections.
13. Be aware of the hazards that exist for the short term, temporary and newly hired employee.
Ensure that new employees receive detailed safety instructions before they are allowed to start work.

1.4 EMPLOYEE (GENERAL)

1. Carry out work in a manner so as not to create a health and safety hazard to yourself or others.
2. Assist in the reduction and controlling of accident and illness producing conditions.
3. Report any incidents, near misses, injuries, or illnesses.
4. Use the correct tools and equipment for the job.
5. Keep tools in good condition.
6. Use the required safety equipment and protective clothing.
7. Report defects in workplace equipment.
8. Develop a personal concern for health and safety -- for yourself and for others, particularly newcomers and young people.
9. Suggest ways to eliminating hazards.
10. Read, understand, and comply with workplace health and safety policy, safe work practices and procedures.
11. Co-operate with health and safety committee members and representatives.

1.5 STANDBY PERSONS (SPECIFIC)

1. The standby person (Top Man) must:
2. Be trained, equipped and capable of initiating or affecting immediate rescue in the case of an emergency.
3. Be qualified and capable of operating the gas detector supplied
4. Fill-out the entry Permit.
5. Be assigned by the Administrator or Supervisor to act as the Standby Person for the CSE being conducted.
6. Conduct atmospheric testing prior to and during entry as required
7. Know who is in the confined space and prevent unauthorized entry.
8. Maintain regular communications with the worker in the confined space.
9. Remain at their station immediately outside the space at all times while the worker is in the confined space.
10. Instruct the worker in the confined space to vacate the space immediately if an unexpected (new) danger or hazard arises, or for any reason the Standby person feels requires it.
11. In the event of an emergency, the standby person must not enter the confined space until back-up assistance has arrived. See Confined Space Rescue section for more details.

1.6 ENTRY PERSONS (SPECIFIC)

1. The Entry Person (Bottom Man) must:
2. Be trained, equipped and capable of making a safe confined space entry.
3. Be assigned by the Administrator or Supervisor to act as the Entry Person for the CSE being conducted.
4. Follow the direction of the Supervisor and/or standby person at all times.
5. Not disconnect their primary lifeline.
6. Vacate the space immediately if they feel the safety equipment in use has been compromised or is not operating properly.
7. Vacate the confined space immediately if they feel any symptoms of illness such as nausea, dizziness, watery eyes or other sudden onset issues.

8. Vacate the confined space immediately if they feel the standby person has broken communication or has left the area immediately outside the confined space for any length of time,
9. Vacate the confined space immediately if they feel the danger or hazards as assessed and recorded in the Hazard Assessment Record have changed in any way.

1.7 COORDINATION OF MULTIPLE EMPLOYERS

For projects where Mar-Tech is the Primary Contractor but will be sub-contracting portions of the work out to other employers, or their workers and any undertaking is likely to create a hazard for a worker of another employer, certain steps must be followed before work can proceed. These are:

1. Notification to the client/owner of each employer/sub-contractor who will work on the site.
2. Appointment of a qualified coordinator for the purpose of ensuring the co-ordination of health and safety activities for the location
3. Provide up-to-date information as required (see below) and have readily available on-site
4. Each employer must give the coordinator appointed the name of a qualified person designated to be responsible for that employer's site health and safety activities.

1.8 WORKPLACE COORDINATOR

The Workplace Coordinator has the following responsibilities:

1. Ensuring the co-ordination of health and safety activities for the location
2. Informing employers and workers of the hazards created
3. Ensuring that the hazards are addressed throughout the duration of the work activities.

1.9 SITE INFORMATION & RECORDS

Below find a list of information required by WorkSafeBC:

1. The name of the qualified, appointed coordinator
2. A site drawing, which must be posted, showing project layout, first aid location, emergency transportation provisions, and the evacuation marshalling station
3. A set of construction procedures designed to protect the health and safety of workers at the workplace, developed in accordance with the requirements of WorkSafeBC Regulations.

2.0 INSTRUCTION & TRAINING

All Mar-Tech employees who will work in the field must receive mandatory annual, formal confined space entry training and certification. New workers who have not yet undergone formal training receive basic CSE instruction during safety indoctrination, which is augmented by hand-on, practical training with an employee who is certified and experienced in CSE Procedures.

2.1 NEW WORKER SAFETY INDOCTRINATION

New workers are to undergo a basic safety indoctrination prior to start of work with Mar-Tech Underground Services. This safety indoctrination is meant to educate new employees to the typical types of hazards that they will encounter while working for Mar-Tech. Safety Indoctrination is typically conducted at the operating facility, and not on-site. Some of the topics covered in the Safety Indoctrination are:

1. PPE Requirements
2. Proper use of PPE
3. Basic Confined Space Entry
4. Basic Safety Orientation

2.2 ON-THE-JOB TRAINING

Employees also receive informal training in the form of on-the-job, practical instruction. This applies to most non-hazardous work, but is also meant to supplement a new workers understanding of safe work procedures for other work, such as Confined Space Entry.

2.3 FORMAL TRAINING

Mar-Tech employees also receive formal Confined Space Entry Procedures training, annually. Formal CSE training and certification prepares workers to:

1. Calibrate, bump test and perform proper atmospheric testing.
2. Recognize confined spaces.
3. Understand the inherent and potential dangers of a confined space.
4. Fill-out confined space entry permits.
5. Effect confined space rescue.
6. Follow Written Instructions for working safely within a confined space as detailed in this manual.

3.0 RECOGNITION OF CONFINED SPACES

3.1 CONFINED SPACE IDENTIFIERS

A confined space is not normally designated or intended for human occupancy. Special precautions are required to protect workers who must enter from flammable or harmful atmospheres, oxygen depletion or enrichment, or situations of possible entrapment. Examples include: tanks, silos, storage bins, process vessels, pipelines, sewers, double hulls, underground utility vaults, boilers, pits, vats and tunnels. Confined spaces have the following general characteristics:

1. Not designated or intended for continuous human occupancy
2. Provide limited means of entry and exit
3. Have poor natural ventilation with the presence of or the potential for a dangerous atmosphere
4. Pose another danger such as entrapment
5. Require special precautions prior to and during entry, including the means for immediate rescue

3.2 CONFINED SPACES ARE NOT INTENDED FOR HUMAN OCCUPANCY

They are not sites of ongoing or regular work activity. They are usually entered only for purposes such as inspection, maintenance, repair or construction.

3.3 CONFINED SPACES HAVE LIMITED MEANS OF ENTRY & EXIT

Entry points may not be designated for easy walk-in. Other limitations include access by ladders or by stairways, which provide poor access because of restrictive slope, narrow width or extreme length. Physical obstructions such as bulkheads, collapsed material or machinery may impede exit. Limited means of entry and exit not only makes escape or rescue difficult, but also can restrict natural ventilation.

3.4 CONFINED SPACES HAVE POOR NATURAL VENTILATION WITH THE PRESENCE OF OR POTENTIAL FOR A DANGEROUS ATMOSPHERE

Poor natural ventilation can be a result of unpredictable or limited air movement, or natural air currents, which could draw, contaminated air into the space. Poor natural ventilation can create a confined atmosphere.

The most common cause of a confined atmosphere is physical enclosure on all sides. However, vats, pits and vessels, which contain confined atmospheres, may be open on one face. In these cases the confined atmosphere may result from entry of a gas, which is heavier than air, the release of a gas from the disturbance of wastes at the bottom of the space or the existence of a temperature inversion above the space, which prevents the movement of air through it. Vessels more than 1.5 meters deep may have poor natural ventilation.

The presence or possibility of an unsafe atmosphere is a key characteristic of a confined space. There are four general types of atmospheric dangers: a lack of oxygen; an excess of oxygen; the presence of flammables; and the presence of toxic substances. The design, location or contents of the confined space may contribute to the danger. Danger could also be produced by work activity within the space such as from welding or during painting.

3.5 CONFINED SPACE IDENTIFICATION & CRITERIA

IDENTIFICATION

1. Is the space intended for human occupancy?
YES = **Not a Confined space.**
NO = Go to question 2.
2. Does the space have poor natural ventilation?
YES = Go to question 3.
NO = Go to question 6.
3. Is an unsafe atmosphere possible prior to entry due to contents or design?
YES = **Confined Space.**
NO = Go to question 4.
4. Is an unsafe atmosphere possible due to work activity in the space?
YES = **Confined Space.**
NO = Go to question 5.
5. Is an unsafe atmosphere possible due to work location?
YES = **Confined Space.**
NO = Go to question 6.
6. Is the space unsafe due to the possibility of entrapment or other potentially dangerous conditions?
YES = **Confined Space.**
NO = **Not a Confined Space.**

3.6 DESCRIPTION OF CRITERIA

1. Human occupancy means location meant for ongoing, regular work activity. Confined spaces are intended only for activities such as inspection, maintenance, repair or construction. Many spaces with limited means of entry and exit are not intended for human occupancy. Limited means may be due to:
 - Entry/exit points not designed for walk-in
 - Ladders or other restricted routes to entry/exit points
 - Physical obstructions (eg. Bulkheads, collapsed material, machinery)
2. Poor natural ventilation can be a result of unpredictable or limited air movement, or natural air currents which could draw contaminated air into the space, Causes include:
 - All sides physically enclosed or if not enclosed, some other condition such as still air or temperature inversion which traps air
 - Small or poorly positioned openings
 - Bulkheads, other obstructions or recesses in the space
 - Location of space near source of air contaminants which could drift in

3. Sources of unsafe atmosphere include:
 - Harmful residues
 - Purge gases
 - Rusting or other condition which could contribute to oxygen depletion
 - Possible discharges from pipes or conduits leading into space
 - Other unknown conditions which could contribute to an unsafe atmosphere
4. Types of activities include:
 - Waste cleanup, sludge removal
 - Preparatory work – chipping, grinding
 - Painting, welding, fibreglassing
5. Possible problems of location:
 - Air contaminants can drift into the space from nearby sources
 - Space is inside an additional structure which contributes to atmospheric trapping
 - Space is underground with possible accumulation of subsurface gases, eg. Methane, hydrogen sulfide or radon
6. Dangers include:
 - Dislodgement of material
 - Dangerous design of space
 - Presence of dangerous equipment in space

4.0 HAZARD ASSESSMENT

Hazard Assessments are to be conducted for each CSE, or each group, work activity, or group of activities, which present similar hazards. The hazard assessment is meant to consider conditions that may exist in the confined space (before workers enter) due to the design, location, and use of the confined space. The assessment must also consider the hazards that may develop during work activity in and around the confined space. The assessment will vary based on the space characteristics, access, and work activities to be performed inside the space. The potential for oxygen enrichment and deficiency, flammable gas, vapor or mist, combustible dust, other hazardous atmospheres; and the presence of harmful substances and other hazardous conditions, prior to and during all work within the confined space. Hazard Assessments are only to be conducted by a “qualified person”, as outlined in Section 9 of WorkSafeBC’s Regulations.

4.1 DESCRIPTION OF SPACE

Municipal and City sewer lines accessed through street level manholes. The space characteristics change but generally speaking are between 4’ and 12’ deep and between 3’ and 4’ wide.

4.2 ASSESSMENT

Assessment of potential hazards inside a confined space is to be assessed and recorded by qualified, appointed personnel only. Refer to Hazard Assessment Report (sample below)

HAZARD ASSESSMENT REPORT - MAR-TECH UNDERGROUND SERVICES

Date: _____ Time: _____ Location: _____

Job #: _____

Type of work: _____

| Hazard Description | Record | Frequency | | | Probability | | | Further Description |
|------------------------------|--------|-----------|-----|------|-------------|-----|------|---------------------|
| | | Low | Med | High | Low | Med | High | |
| Energy | | | | | | | | |
| Electrical | | | | | | | | |
| Thermal | | | | | | | | |
| Mechanical | | | | | | | | |
| Pressure | | | | | | | | |
| Hazardous Atmospheres | | | | | | | | |
| Oxygen Deficient | | | | | | | | |
| Oxygen Enrichment | | | | | | | | |
| Flammable Gases | | | | | | | | |
| Combustible Dust | | | | | | | | |
| Corrosive Materials | | | | | | | | |
| Toxic Materials | | | | | | | | |
| Hydrogen Sulfide | | | | | | | | |
| Other Gases | | | | | | | | |
| Physical | | | | | | | | |
| Engulfment | | | | | | | | |
| Entrapment | | | | | | | | |
| Slips | | | | | | | | |
| Electrocution | | | | | | | | |
| Unstable Surfaces | | | | | | | | |
| Noise | | | | | | | | |
| Other Hazards | | | | | | | | |
| Temperature | | | | | | | | |
| Lighting | | | | | | | | |
| Obstructed Exit | | | | | | | | |
| Respiratory | | | | | | | | |
| Cramped Position | | | | | | | | |
| Workload | | | | | | | | |
| Other | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Created: _____

Work Station: _____

Other Comments & Remarks: _____

Hazard Assessment By: _____ Signature: _____

Example of Mar-Tech Hazard Assessment Report

4.3 PROCEDURES FOR CONDUCTING HAZARD ASSESSMENTS

Firstly, hazard assessments are only to be carried out by the qualified person or his/her delegate, as per the Responsibilities section of this document (above). Hazard assessments must only be carried out by someone who is qualified through experience and training to conduct them.

4.4 FILLING OUT HAZARD ASSESSMENT FORMS

1. Fill out the header portion of the Hazard Assessment Report.
2. Assess the Confined Space for each of the types of Hazards, including their details as defined on the left-columns of the Hazard Assessment.
 1. Energy – Electrical, Pneumatic, hydraulic & radiation
 2. Atmospheric – Oxygen rich or deficient, flammable or toxic gases
 3. Physical – Design of the manhole, vibration, noise, visibility, slips and falls, etc.
 4. Other – anything else deemed a potential hazard.
3. Indicate whether the hazard is present at the time of assessment by checking in the yes or no column.
4. If the hazard is present, indicate the degree of risk (low, moderate or high) and give a description of the Hazard in the Further Description area.
5. Next, note what measures taken to control or eliminate the hazard in the far right column.
6. Continue for each of the hazards possible.
7. At the bottom of the second page indicate the names of the crew members directly involved in the work.
8. Note the Responsibility of each crew member, and have each of them sign to indicate they have acknowledged their appointment to the role.
9. Add in any other comments or remarks, then enter your name, responsibility and signature.
10. Post the hazard assessment report outside the access point with the Entry Permit.

4.5 HAZARD ASSESSMENT DESCRIPTORS

Below is a list of possible Hazard Type Descriptors and their meanings.

A. Electrical Energy

Refers to the presence of electrical energy, such as that carried by any tools being used in the confined space as well as existent electrical wiring in and around the space.

B. Pneumatic/Hydraulic Energy

Specific to the use of air and/or hydraulic tools.

C. Radiation

Refers to the presence of radiation within the confined space.

D. Engulfment/Immersion

Weather conditions may cause an overflow of the sewage system if it is a storm sewer or sanitary/storm combined. The workers and standby personnel must be aware of the effects of rainfall on the system.

E. Oxygen Deficiency

Oxygen Deficiency indicates an oxygen level below normal. Before entry and during work the atmosphere must be tested for Oxygen deficiency. (>19.5% & <23%).

F. Oxygen Enrichment

Oxygen enrichment indicates the atmosphere has elevated levels of oxygen in it. Elevated Oxygen levels can cause fire or explosions.

G. Flammable Gases

Before entry and during work the atmosphere must be tested for the presence of flammable gases. (LEL below 10%).

H. Carbon Monoxide

Before entry and during work the atmosphere must be tested for Carbon Monoxide. (Below 25 ppm).

I. Hydrogen Sulfide

Systems may have raw (untreated) sewage running through them. Consequently the possibility of the presence of hydrogen sulfide is there. The atmosphere must be tested prior to entry and continuously for the presence of hydrogen sulfide. (Below 10 ppm).

J. Other Toxic Gases:

Refers to the presence of other toxic gases such as Carbon Dioxide and Chlorine Gas.

K. Slip and Fall

The areas inside the manhole are accessed by a permanent ladder. The possibility of slipping on this ladder is present especially if it is wet and/or the ladder rungs are rusted or otherwise corroded and incapable of sustaining the weight of the worker.

L. Bio-Infectious

This system has raw sewage running through it, consequently the possibility of the presence of bio-infectious contaminants exists. Equipment, tools and clothing may be contaminated. Protective gloves, coveralls, and footwear must be worn if contact is possible. Hands must be washed thoroughly with an anti-microbial soap before eating, drinking or before any contact between hands and face. Also complete wash up must be done when finishing work.

4.7 HAZARD CONTROL

Means for controlling and/or eliminating identified hazards must be developed prior to the start of work. In some cases, the client/owner may require that these written procedures be submitted prior to the commencement of work. It is the responsibility of the project supervisor to facilitate and provide these documents as requested. Recording of hazard controls is done through use of Hazard Control Reports. Any hazards identified on the Hazard Assessment Report must have at least one Means of Control. For each Hazard identified on the Hazard Assessment report, a Hazard Control Report must be generated.

5.0 ENTRY PERMIT

A confined space entry Permit must be filled out completely and posted at the entrance before each and every entry (Sample below).

CONFINED SPACE ENTRY RECORD - MAR-TECH UNDERGROUND SERVICES

JOB #: _____ GAS DETECTOR #: _____

LOCATION: _____ CREW: _____

LAST BUMP TEST: _____

PROCEDURE CHECK-LIST (ALL PROCEDURES MUST BE FOLLOWED - NO EXCEPTIONS)

- 1. Install proper signage and cones to mark safe boundary around confined space entrance/exit
- 2. Proper hazard assessment by qualified personnel. Record findings on Hazard Assessment Report.
- 3. Atmosphere test of manhole - record data
- 4. Set up proper ventilation (blowers). Fully cycle fresh air into space prior to entry. Vent confined space for entire duration of entry.
- 5. Set up tripod. Double-check fall arrest is functional and all visible moving parts are mechanically sound
- 6. Put on all necessary safety gear (PPE & Fall Arrest)
- 7. Attach safety cable to harness of employee to be lowered
- 8. Lower worker
- 9. Remove worker

| DATE | LOCATION (STREET) | MANHOLE # | GAS MONITOR READINGS | | | | TIME 24HR CLOCK | TESTER INITIALS |
|------|-------------------|-----------|----------------------|-------------------|--------------------------|----------------------------|-----------------|-----------------|
| | | | OXYGEN (O2 %) | FLAMMABLE (LEL %) | CARBON MONOXIDE (CO PPM) | HYDROGEN SULFIDE (H2S PPM) | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Comments: _____

Signature

5.1 ATMOSPHERE TESTING & MONITORING

Pre-entry testing and continuous monitoring of the atmosphere will be conducted by qualified personnel. Details such as the calibration date, gas detector serial number and a checklist of safety measures taken will be recorded on the entry permit. The test results for Oxygen, Flammables, Carbon Monoxide and Hydrogen Sulfide will be recorded on the entry permit.

The permissible readings are:

- Oxygen** >19.5% & <23%
- Flammables** LEL below 10%
- Carbon Monoxide** Below 25PPM
- Hydrogen Sulfide** Below 10PPM

If readings are outside these levels, workers must immediately exit the space and not return until the source has been identified and controlled and the space has been ventilated to within the acceptable parameters.

The atmosphere must be tested at the beginning of each shift and after breaks of 20 minutes or more.

5.2 POSTING OF AREA

The work area will be protected from traffic by traffic cones and signs. The entrance will be posted as a confined space and an entry permit will be completed and posted for each entry.

5.3 VENTILATION

1. The space will be CONTINUOUSLY ventilated with clean, respirable air by a portable blower. The blower will create airflow of a minimum of (50 cubic feet per minute) per worker in the confined space.

2. Ducting will be used to direct airflow into the workspace to ensure efficient air exchange. The space must be ventilated for a minimum of 20 minutes after initial testing and prior to entry.
3. After the 20-minute ventilation, the air must be tested again and the results recorded on the entry permit.
4. The atmosphere must be continuously ventilated while work is being performed.

5.4 MANDATORY MINIMUM SAFETY EQUIPMENT

1. 1 (one) combination combustible gas, toxic gas, oxygen detector/tester.
2. 1 (one) ventilation unit (consists of 1 (one) model &8C HP leader fan complete with model HCH8 hose container & hose)
3. 1 (one) first aid kit (minimum size #2)
4. Full, parachute-style body harness
5. Tripod with manlift

5.5 PERSONAL PROTECTIVE EQUIPMENT (PPE)

There are additional PPE requirements when a worker will enter a confined space. The complete list follows:

1. Hard hat
2. Cover-alls (full length arm/length coverage)
3. Safety footwear (hard-toes boots)
4. Gloves (PVC)
5. Eye protection (Safety goggles)
6. Hearing protection (Ear plugs or muffs)

Each crew member that enters a confined space must wear an approved parachute-type safety harness complete with attached approved safety line which is tended at all times by another person stationed outside the entrance to the confined space.

REMEMBER:

IF YOU CAN'T TEST,

IF YOU CAN'T VENTILATE,

DO NOT ENTER!!!

A worker's COMMON SENSE is still his best ally. One of the simplest and best safety rules to follow is this:

IF SOMETHING DOESN'T SEEM RIGHT, DON'T DO IT! YOU HAVE THE RIGHT OF REFUSAL!

6.0 CONFINED SPACE ENTRY PROCEDURES

The following safe work practice procedures are to be followed by all workers involved in confined space entry:

1. Establish Confined Space Rescue

Prior to arriving at worksite, establish emergency numbers and a definite location in the event EHS or rescue personnel must be summoned.

2. Safe Parking

Establish a safe parking area for all work vehicles and equipment, using the work truck(s) as a buffer wherever possible.

3. Traffic Control

Set up traffic control as per the Traffic Control Manual for work on Roadways (the Traffic Control Manual) issued by the Province of British Columbia Ministry of Transportation & Highways. It is critical that

4. Posting of Area

Place approved barricade and/or approved markers, cones, signs, lights, flagging tape, etc. around the opening.

5. Hazard Assessment

Appointed Supervisor to conduct Hazard Assessment of the confined space & record results

6. Set-up Safety Equipment

- a. Tripod
- b. Lifeline(s)
- c. Ventilation fans & ducting
- d. Other safety equipment as needed

7. Fill-out Entry Permit

Complete pre-entry information on entry permit. Workers, standby personnel and supervisor sign permit.

8. Atmosphere Testing

Perform pre-entry atmospheric tests and record results and time on permit.

- If the tests find permissible atmospheric conditions, proceed to 15.
- If the tests find that the atmosphere is still non-permissible, proceed to 9 or 10 below.

9. Lack of Oxygen or Presence of Toxic Gases

If atmosphere testing shows an atmosphere that is lacking in oxygen or that has toxic gases present, the standby person is to:

- a. Inform the supervisor
- b. Ventilate the confined space for a period of at least 10 minutes.
- c. Re-test confined space atmosphere
- d. If permissible levels still do not exist, repeat steps from **9a** as required.
- e. Once atmosphere testing shows the space is safe, go to **15**.

10. Presence of combustible/flammable gases

- a. Inform supervisor
- b. All potential sources of ignition shall be eliminated (no smoking, flares, etc.)
- c. Ventilate for a period of at least 10 minutes.
- d. Re-test the confined space atmosphere
- e. If permissible levels still do not exist, repeat steps from **10a** as required.
- f. Once atmosphere testing shows the space is safe, go to **15**.

11. Monitor atmosphere constantly while work is being done in confined space

12. Increase record of atmosphere testing

If an atmosphere test has shown a non-permissible atmosphere at any point in time during testing, increase record of testing to every 5 minutes instead of 15.

13. Use Extreme Caution

Especially when entering confined space in commercial or industrial areas. Be aware of any service stations, paint stores, printing shops, dry-cleaning plants, chemical plants, garbage dumps, etc. in the area. If it doesn't feel safe, do not enter.

14. If in doubt about any tests performed, re-test.

Remember that lives may depend on testing accuracy. If you are unsure of any result, re-test to confirm readings before anyone enters the space.

15. Start ventilation of space

Install ventilator fan and hose.

16. Re-test atmosphere and record results and time on entry permit

Record atmosphere test results every 15 minutes as long as the atmosphere is permissible. If at any time an atmosphere test shows a non-permissible level, go to step 9 or 10, depending on the nature of the reading.

17. Allow fresh air to completely cycle through the space

18. Establish standby station and allow worker to enter space

19. Continuously ventilate space while working.

20. Continuously monitor atmosphere while working in space.

If at any time an atmosphere test shows a non-permissible reading, go back to step 9 or 10, depending on the nature of the reading.

21. Re-test before any re-entry

7.0 PROPERTIES OF GASES & VAPOURS

Below is a list of some of the gases and vapors that may be found in confined spaces.

| GAS/VAPOUR | FLAMMABLE | PHYSICAL DESCRIPTION | MAIN DANGER | MAX. LEVEL PERMITTED IN AIR | DENSITY (2) (compare to air=1) |
|-------------------------------------|-----------|--|--|--|--------------------------------|
| Argon | No | Colorless, Odorless | Displacement of Oxygen | Ensure Oxygen is greater than 18% at all times (4) | 1.4 |
| Carbon Dioxide (CO ₂) | No | Colorless, Odorless | Displacement of Oxygen + Toxic | 5000 ppm (1) | 1.5 |
| Carbon Monoxide (CO) | Yes | Colorless, Odorless | Toxic, asphyxiant | 25 ppm (1) | 0.97 |
| Chlorine | No | Greenish/yellow color, sharp, pungent odor | Toxic – severe lung and eye irritant | 0.5 ppm (1) | 2.5 |
| Gasoline Vapors | Yes | Colorless, sweet odor | Fire and Explosion | 500 ppm (1) | 3.5 |
| Hydrogen Sulfide (H ₂ S) | Yes | Colorless, rotten egg odor (3) | Extremely toxic – can cause lung failure | 10 ppm 3(1) | 1.2 |
| Methane (CH ₄) | Yes | Colorless, odorless | Fire and Explosion | 20% of LFL | 0.6 |
| Nitrogen (N ₂) | No | Colorless, odorless | Displacement of Oxygen | Ensure Oxygen is greater than 18% at all times (4) | 0.97 |
| Nitrogen Dioxide (NO ₂) | No | Reddish brown color; pungent odor | Toxic – severe lung irritant | 1 ppm (1) | 1.6 |
| Sulfur Dioxide (SO ₂) | No | Colorless, Suffocating odor | Toxic – severe lung irritant | 2 ppm (1) | 2.2 |

1. The levels are 8-hour average exposure limits, except for nitrogen dioxide, where the level is a ceiling limited, not to be exceeded at any time.
2. Concentrated gases with a density more than one may, in the absence of air currents, tend to settle in low areas; those less than one rise.
3. Exposure deadens the sense of smell
4. Where air-purifying respirators are worn, oxygen content of the air must exceed 19.5% (NIOSH approval).

8.0 RESCUE & FIRST AID

Rescue & First Aid are important components of the CSE Program. It is critical that all employees be familiar with the proper Emergency Response, First Aid & Rescue protocols and procedures as follows:

8.1 RESCUE

In the event of an accident, the following confined space rescue protocols are to be observed:

- A standby (holewatch) person shall remain in constant communication with the entrant.
- The hole is considered to be IDLH until it can be proved otherwise.
- No further entries can occur into the space.
- All standby persons must possess the means to contact First Aid directly, without leaving the immediate area of the confined space access/egress point. This can be cellular telephone, direct radio contact, etc

If an entrant advises the standby person that an injury has occurred, then the standby person will immediately notify the site First Aid Attendant. All personnel shall be advised during the pre-job orientation training that in the event of an emergency or should the need arise to evacuate the entrant from the space, all instructions shall be issued by the rescue coordinator.

In the event that the entrant loses consciousness and/or fails to respond to a periodic check from the standby person at the entrance, the standby person shall immediately contact the rescue services by dialing 911. Rescue will be coordinated by the rescue coordinator.

1. Remember, the space is assumed to be IDLH until proven otherwise.
2. Rescue personnel will enter the space only if they have been properly trained and are equipped to perform the rescue. All rescue personnel must be monitored by a standby person.
3. If the hazard is a low risk, and the injured person is in no immediate danger, the rescue personnel will stabilize the victim and EHS and emergency response summoned.
4. If the hazard is identified as high risk, the injured worker will be moved to a safe environment, stabilized and EHS and emergency response summoned.
5. Rescue Personnel will wear a full body harness and lifeline.
6. There will be at least one rescue team member with an OFA first aid certification.

REMEMBER:

CONFINED SPACE RESCUE IN AN EMERGENCY SITUATION DEMANDS DELIBERATE THOUGHT AND ACTION. YOU ARE OF NO USE TO THE VICTIM IF YOU ARE OVERCOME IN THE SAME WAY AS THE VICTIM. YOU MAY BE THE PERSONS ONLY CHANCE OF SURVIVAL. DO NOT JEOPARDIZE HIS LIFE AND YOURS BY RASH ACTIONS.

8.2 RECOVERY

The entrant recovery protocol to follow if a person loses consciousness or is otherwise unresponsive in a confined space are as follows:

1. Do not enter the space yourself, or allow anyone else to enter the space for any reason!
2. Contact first aid personnel immediately. This may be Ambulance or site first aid depending on the job site.
3. If the lifeline and harness have become detached and/or entangled, direct the air venting hose to as close to the victims face so as to supply the victim with as much oxygen as possible.
4. If the lifeline and harness are intact and not entangled, engage the crank of the self-retracting life-line (SRL) and begin to raise the person up towards the opening of the confined space; generally the manhole opening.
5. If you cannot hoist the entrant out of the space and into fresh air, direct the air venting hose to as close to the entrants face as possible so as to supply the victim with as much oxygen as possible and wait for help to arrive to effect rescue.
6. If you can hoist the entrant out of the space and into fresh air, do so.
7. Move entrant away from access/egress point (manhole) and detail lifeline.
8. Apply First Aid as necessary

8.3 FIRST AID

First Aid Protocols for confined space entry personnel once recovered are as follows:

1. Check if the entrant is breathing.
2. If the entrant is breathing, keep them warm and comfortable until help arrives. Continue to monitor pulse and breathing. Apply oxygen if available.
3. If breathing has stopped, apply artificial respiration until breathing is restored.
4. If breathing cannot be restored, continue resuscitation until qualified personnel are in control of the situation
5. If emergency personnel cannot be contacted, transport the entrant to the nearest medical facility (doctor, hospital, etc)

9.0 ENTRY SITE SET-UP CHECKLIST

Use the following checklist to confirm proper preparation of the worksite for confined space entry. If you cannot conduct all of the following necessary safety procedures, do not make or allow to be made the confined space entry!

- Confined Space Rescue Protocol in Place
- Safe Parking of Work Vehicles
- Traffic Control In Position
- Posting of Area
- Hazard Assessment Completed & Posted
- Hazard Controls Completed & Posted
- Tripod Set-up
- Lifelines
- Ventilation fans and ducting
- Check PPE and complete PPE section of permit.
- Complete pre-entry information on entry permit.
- Workers, standby personnel and supervisor sign entry permit.
- Perform pre-entry atmospheric tests and record results and time on permit.
- Start ventilation of space
- Re-test atmosphere and record results and time on entry permit.
- Establish standby station and enter space.
- Continuously ventilate space while working.
- Continuously monitor atmosphere while working in space.
- Re-test before any re-entry.

10. GLOSSARY OF TERMS

Asphyxia

The extreme condition caused by lack of oxygen and excess of carbon dioxide in the blood, produced by interference with respiration or insufficient oxygen in the air; suffocation.

Asphyxiant

A substance, such as a toxic gas, or an event, such as drowning, that induces asphyxia.

CFM

Cubic Feet per Minute

EHS

Emergency Health Services

IDLH

IDLH is an initialism for Immediately Dangerous to Life and Health, and is defined by the NIOSH as exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment." Examples include smoke or other poisonous gases at sufficiently high concentrations.

LEL

The explosive limit of a gas or a vapour, is the limiting concentration (in air) that is needed for the gas to ignite and explode. There are two explosive limits for any gas or vapor, the lower explosive limit (LEL) and the upper explosive limit (UEL). At concentrations in air below the LEL there is not enough fuel to continue an explosion; at concentrations above the UEL the fuel has displaced so much air that there is not enough oxygen to begin a reaction. Concentrations of explosive gases are often given in terms of percent of lower explosive limit (%LEL).

Non-permissible Atmosphere

The atmosphere has been deemed unsafe for confined space entry.

OFA

Occupational First Aid

PPE

Personal Protective Equipment

PPM

Parts per Million

Permissible Atmosphere

The atmosphere is deemed safe for confined space entry.