Confined Space Entry
Northwest Territories and Nunavut
OH&S Compliant

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Second Edition

March 12, 2020

Saga Universal Training Corp. is dedicated to reducing deaths caused by illness and injury. It is expected that an employer will take the fundamentals of this training and apply them to their specific equipment and workplace.

Readers should not assume that reviewing this manual alone constitutes complete training.

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Saga Universal Training Corp. wishes to acknowledge the efforts of all the people who contributed to the writing, editing, and layout of this manual.

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Disclaimer

It is expected that an employer will take the fundamentals of this training and apply them to their specific workplace.

Job and / or familiarization of workers in specific workplace environments are in addition to this training.

Although every effort is made to ensure the accuracy, currency and completeness of the information.

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Course Description

Program Overview

- This course is designed to introduce the learner to the basic concepts, hazards, hazard control processes and safe work procedures associated with confined spaces.

- The course includes all requirements of Northwest Territories and Nunavut Safety Act and Regulations pertaining to work in confined spaces.

- The course includes requirements of CSA Z1006-16 Management of work in confined spaces.

- Due to the different policies and procedures and equipment utilized on different work sites certain statements in this program may not apply.

- The course is intended to supplement a company's larger Health & Safety Management System.

Certification:

At the end of each chapter there will be a multiple choice, open-book exam of which, at least 80% correct must be achieved.

Certificates of training issued by Saga Universal Training Corp. must be recognized by the employer and are valid for 3 years from the date of completion.

Course Goals:

- The student should understand the relationship between Legislation, Regulations, Standards, Due Diligence, and Best Practices.

- The student should understand the roles and responsibilities of employers and employees and workplace programs as they relate to working in confined spaces.

- The student should be aware of hazards associated with a confined space.

- The student should understand how to evaluate and identify proper hazard controls associated with a confined space.

- The student should understand the safety procedures and equipment required for working in confined spaces.

- The student should understand the requirement for emergency response and the basic elements of an emergency response for confined space.

Exposure to Harm

- A confined space can be found at almost any work site.
- Crawl spaces, cramped mechanical rooms, mezzanine areas, plumbing or electrical vaults, cargo containers and attic spaces can all fit within the definition of a confined space, depending on the design, access and work activities taking place.
- Confined spaces have a history of being dangerous places to work as hazards within them are often magnified.
- Limited access may be combined with poor ventilation, hazardous surroundings or energized equipment.
- Workers unknowingly entering an oxygen deficient or toxic atmosphere, can be fatal.
- Working in a confined space is 150 times more dangerous than doing the same job outside the confined space.
- Some of the incidents resulted in the death or injury of several workers, including those trying to rescue the first worker in distress.
- The majority of deaths in confined spaces are caused by hazardous atmospheres such as toxic gases or lack of oxygen.
- The remaining deaths are the result of physical hazards, where workers may be crushed, struck by falling objects, or buried in materials.

Chapter 1 Oversight:

There are many layers of oversight of safety requirements in the workplace that are often in a hierarchical form of priority. For example, federal laws and regulations normally supersede provincial and territorial authority, but in some instances the federal government has given authority to the provinces and territories.

Goal:

The student should have an awareness of the various legislation, regulations, and standards that pertain to workplace health and safety.

Objectives:

1. The student should understand the relationship between Legislation, Regulations, Standards, Due Diligence, and Best Practices.

2. The student should be aware of the regulations that pertain to working in confined spaces.

3. The student should be aware of the key elements of a health and safety program.

Students Notes

Legislation

Criminal Code of Canada Section 217.1

- One of the farthest-reaching mechanisms of oversight regarding health and safety is Section 217.1 of the Criminal Code of Canada, it is where “due diligence” is defined in law:

“Everyone who undertakes, or has the authority, to direct how another person does work or performs a task is under a legal duty to take reasonable steps to prevent bodily harm to that person, or any other person, arising from that work or task.”

Canada Labour Code Part ll

- In Canada OH&S is a provincial jurisdiction and every province has its own OH&S legislation, code, and regulations.
- However, some industries are federally regulated, which can bring OH&S for those industries under the Canadian Labor Code and under federal jurisdiction.
- Federal health and safety legislation are found in Part ll of the Canada Labour Code and Regulations.
- The Canada Labour Code applies to employees of the Federal Government, the Post Office, airports, banks, canals, highway transport, pipelines, radio and television broadcasting, railways, shipping services, and many more.
- All Provinces and Territories must meet the minimum requirements of the Canada Labour Code and Regulations in their own legislation and are certainly encouraged to exceed them.
- Approximately 90% of the Canadian workforce falls under the OH&S legislation of the province or territory in which they work.

Provincial / Territorial Legislation and Regulations

This information is for awareness purposes only. You must familiarize yourself with specific regulations that pertain to you and your worksite.

- The Northwest Territories and Nunavut Safety Act and Regulations apply to every occupation, employment and business.

Northwest Territories and Nunavut Safety Act,

Follow the link below and familiarize yourself with:
Part 4 Duty of employer
Part 5 Duty of worker
Part 13 (2) Right to refuse work
Part 22 Offence and punishment

https://www.justice.gov.nt.ca/en/files/legislation/safety/safety.a.pdf

Northwest Territories and Nunavut, Occupational Health and Safety Regulations
Follow the link below and familiarize yourself with:

Interpretation

Application

Part 1 (4) General Duties Not Limited

Part 3 General Duties;
- (14) Young Persons,
- (33) Working Alone or at Isolated Work Site,
- (66) Asphyxiation and Poisoning,
- (69) Ventilation and Air Supply,
- (72) Space,
- (73) Lighting,
- (74) Thermal Conditions

Part 7 Personal Protective Equipment;
- (91) Respiratory Protective Devices,
- (93) Working in Dangerous Atmospheres,
- (102) Exposure to Hazardous Substances

Part 8 Noise Control and Hearing Conservation

Part 10 Machine Safety; (147) Locking Out

Part 17 Excavations, Trenches, Tunnels and Excavated Shafts

Part 21 Chemical and Biological Substances; (316) Respiratory Protective Devices

Part 22 Hazardous Products and Workplace Hazardous Materials Information System

Part 25 Silica and Abrasive Blasting; (390) Sandblasting

Part 26 Fire and Explosion Hazards;
- (403) Flammable or Explosive Substance in Atmosphere,
- (404) Hot Work,
- (408) Piping

https://www.justice.gov.nt.ca/en/files/legislation/safety/safety.r8.pdf

Part 18 Confined Space Entry is the core material presented in the course.

Regulations

- Workplaces must meet the minimum requirements of the Safety Act and OH&S Regulations but are also encouraged to exceed them.

- Whether the workplace simply meets or chooses to exceed the minimum of the regulations, the employer should document their regulations into the company's safe work policies and procedures manual.

Standards

- OH&S regulations often refer to standards where the regulation will require the worker to follow a specific standard or use equipment that has met the requirements of a specific standard.

- The standards organizations are not the government so they cannot implement regulations.

- However, the standards organizations are made up of experts in various disciplines. The standards organizations most frequently referenced in OH&S regulations are:

- CSA Group, formerly the Canadian Standards *Association* (CSA) (CAN/CSA)
- American National Standards Institute (ANSI)

Others Include:

- American Society of Safety Engineers (ASSE),
- European Committee for Standardization (CEN), or in French: (Comité Européen de Normalisation) Conformité Européenne (CE),
- National Fire Protection Association (NFPA),
- Underwriters Laboratories (UL),
- Underwriters Laboratories of Canada (ULC),
- Safety Equipment Institute (SEI).

For compliance purposes, any equipment required to meet specific standards must bear the mark or label of a nationally accredited testing organization such as CSA or ANSI, as evidence that the equipment has been approved to the requirements of the Standard.

Use caution when purchasing equipment required to meet the various standards. Manufacturers must meet stringent criteria to have their equipment tested to these standards. There have been cases of fraud where equipment has not been tested to the standards criteria and counterfeit marks are placed on the equipment. It is always best to purchase equipment from reputable and authorized dealers.

The Bottom Line

When a regulation requires certain standards to be followed, they must be followed just as if they were written verbatim in the regulation.

Due Diligence

- Applied to occupational health and safety, due diligence means that employers shall take all reasonable precautions, under the particular circumstances, to prevent injuries or accidents in the workplace.

  Note: The wording is very similar in the Criminal Code of Canada Section 217.1.

Best Practices

- A best practice is a method or technique that has been generally accepted as superior to any alternatives because it produces results that are superior to those achieved by other means, or because it has become a standard way of doing things.

- Best practices are used to maintain quality as an alternative to mandatory legislated standards and can be based on self-assessment or benchmarking.

- A procedure that has been shown by research and experience to produce optimal results and that is established or proposed as a standard suitable for widespread adoption.

- There are some standards that are not required to be followed by any regulations, but individuals and groups follow them because they produce results.

Best Practice vs. Due Diligence

- If due diligence in health and safety means to take all reasonable precautions, and best practices are used to maintain quality as an alternative to mandatory legislated standards; then wouldn't following best practices be considered an example of due diligence?

- A standard not required through a regulation but has been generally accepted as superior could be considered a best practice and therefore should be followed to meet due diligence.

  Note: Can you think of an example of best practices and due diligence being followed at your worksite?

Reasonably Practicable

- In occupational health and safety the term “reasonably practicable” is frequently used.

- Reasonably practicable is a recognized term that is assessed using the reasonable person test.

- That is, what would a dozen of your peers consider reasonable in similar circumstances.

- Your peers would likely review what you did and compare it to what they do in their own operations.

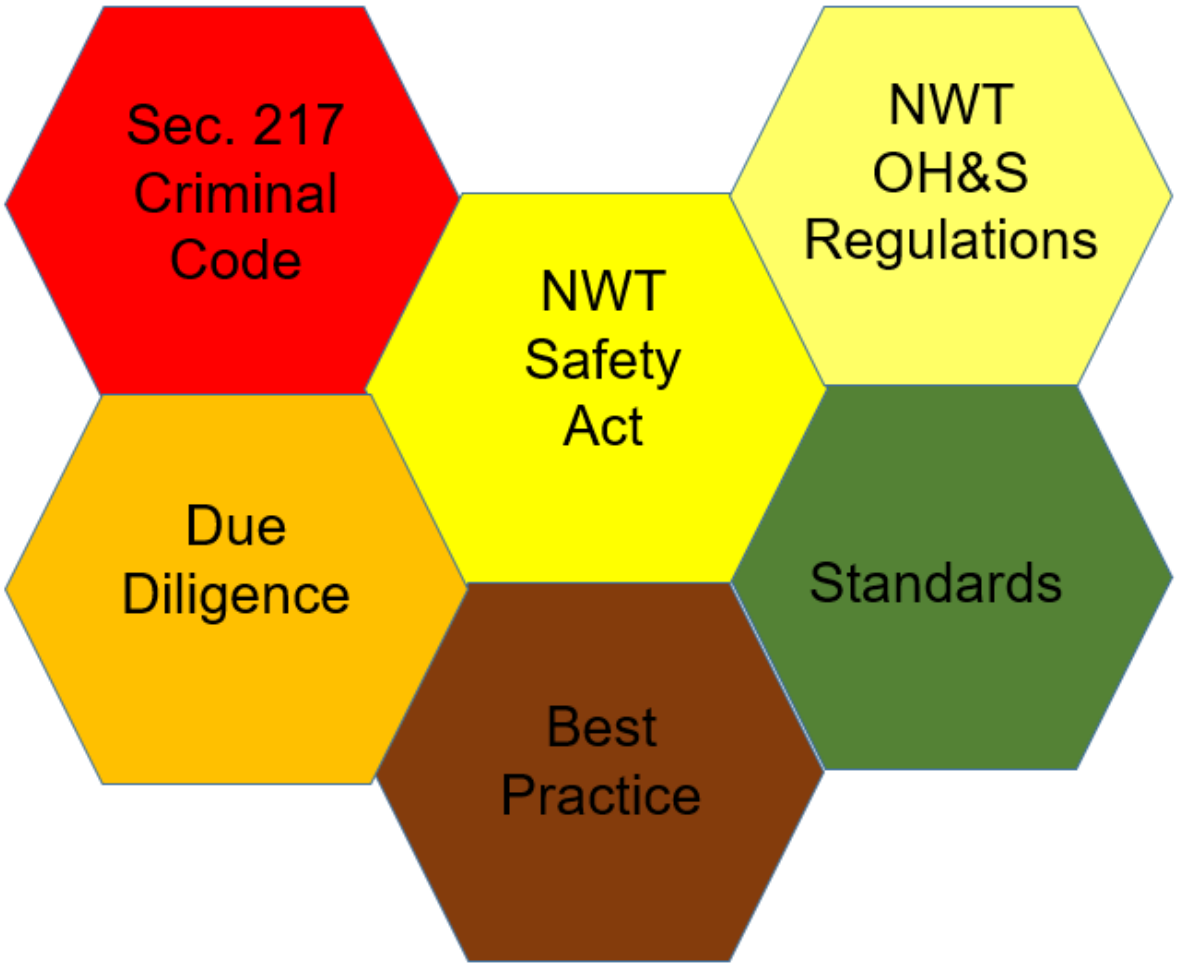
- Some might do more, others less.

Requirement to Comply

Notwithstanding the requirement for competency (training and experience), appropriate equipment, and the right to refuse unsafe work:

- If legislation, regulations, or an adopted code imposes a duty on an employer, the employer must ensure that duty is met in accordance with the legislation, regulations, or the adopted code.

- If legislation, regulations, or an adopted code imposes a duty on a worker, the worker must perform that duty, and the employer must ensure the worker performs that duty in accordance with the legislation, regulations, or the adopted code.



The Bottom Line

Employers and workers must ensure they understand under which authority they are working and be familiar with the legislation, regulations and standards they must follow.

Key Elements of a Health and Safety Management System

- An organized approach through a company Health and Safety Management System is necessary to ensure all roles, responsibilities, and program requirements are met or exceeded. Elements which should be included are:

- Training, Information and Auditing.
- Management, Supervision and Internal Responsibility.
- Job Planning and Hazard Assessments.
- Safe Operating Procedures.
- Prevention of Injuries.
- Equipment Maintenance and Modifications.
- Facility Design.
- Emergency Plan.
- Additional safety training may such as First Aid, WHMIS, Transportation of Dangerous Goods, Spill Containment, Ground Disturbance, Fire Safety, etc.

Chapter 1 Summary:

What was covered in Chapter 1?

- The relationship between Legislation, Regulations, Standards, Due Diligence, and Best Practices.
- A brief overview of some of the regulations that pertain to working in confined spaces.
- The key elements of a health and safety program.

Chapter 2: Ensuring a Safe Worksite

Goal:

The student will understand the roles and responsibilities of employers and employees and workplace programs as they relate to working in confined spaces.

Objectives:

1. The student should be aware of employers' and employees' responsibilities as they relate to working in confined spaces.

2. The student should be familiar with the definition of a confined space.

3. The student should be familiar with the process for identifying confined spaces.

4. The student should be familiar with the Northwest Territories and Nunavut Safety Act and Regulations' requirements for confined spaces.

5. The student should be familiar with the Northwest Territories and Nunavut Safety Act and Regulations' requirements with respect to an Entry Plan and Codes of Practice for working in a confined space.

6. The student should be familiar with the 3 steps for preparing a confined space entry codes of practice.

7. The student should be familiar with the minimum training requirements for workers to receive training for confined spaces.

Confined spaces are not intended for continuous human occupancy. Even if confined space entry is done frequently at the work site, they are not sites of ongoing or regular work activity.

Typical Reasons for Entering a Confined Space:

- Cleaning to remove sludge and other waste materials.
- Inspecting process equipment.
- Maintenance such as abrasive blasting and applying surface coatings.
- Tapping, coating, wrapping and testing underground sewage, hydrocarbon, steam and water piping systems.
- Installing, inspecting, repairing, and replacing, valves, piping, pumps, motors, etc. in below ground pits and vaults.
- Checking and reading meters, gauges, dials, charts and other measuring instruments.
- Rescue of workers who are injured or overcome while inside the confined space.

Employer and Employee Responsibilities

- This information is a high-level summary of the many responsibilities of workplace parties, it describes the intent of employer / employee responsibilities.

- You should be familiar with all regulations that pertain to you as an employer, employee, contractor, supplier, etc. as described in the Northwest Territories and Nunavut Safety Act, and Regulations.

Employer Responsibilities

- The primary purpose of OH&S laws is to keep workers safe. Under OH&S laws, employers are ultimately responsible for all persons on their worksite.

- Employers must develop safety policies and procedures for its workers, ensure the workers are aware, understand, and follow all regulations and employer policies / procedures.

Employee Responsibilities

- Employees must, while at work, make all reasonable efforts to ensure the safety of all persons at the worksite, including other workers, traffic and pedestrians and follow all regulations, employer policies / procedures.
- Employees have the right to refuse to work on a job or in any workplace, or to operate any equipment if they have reasonable grounds to believe that it would be unsafe or unhealthy to do so.

Confined Spaces Explained

- Non-hazardous and hazardous confined spaces share certain common characteristics.
- The key difference is if hazards are present or not.

A confined space is:

- An enclosed or partially enclosed space,
- That is not designed or intended for continuous human occupancy,
- With a restricted means of entry or exit.
    - Entry points may not be designed for easy walk in.
    - Other limitations include access by ladders or by stairwells that provide poor access because of steep slope, narrow width or extreme length.
    - Physical obstructions such as bulkheads, collapsed material, or machinery may impede exit.
    - Limited means of entry / exit would not only make escape and rescue difficult but could also restrict natural ventilation.

- Most confined spaces can be classified in one of two ways:
    - Spaces that are open-topped and have depth including pits, wells, vats, hoppers, bins, degreasers, and kettles.
    - Spaces with narrow openings including pipes, tunnels, silos, casings, and sewers.
- Confined spaces may have poor natural ventilation and contain, or may contain, an unsafe atmosphere.
- Poor ventilation can be the result of unpredictable or limited air movement or air currents that draw contaminated air into the space.

Non-hazardous Confined Space

- A non-hazardous confined space can be thought of as a work area in which the only hazard is the difficulty of getting into or out of the space and are sometimes referred to as a “restricted space” or a “nonpermitted confined space”.

- All other hazards are either non-existent or have been eliminated or controlled as required by regulations.

- A non-hazardous confined space will not become hazardous to a worker entering it due to a hazardous atmosphere, potential for injury or illness, or activities outside the space having an effect upon workers inside the space.

- Non-hazardous confined spaces are not subject to the permitting, atmospheric testing and tending worker requirements of a hazardous confined space, however on some sites employers may require permits and atmospheric testing for non-hazardous confined spaces.

- Employers and workers must be mindful that a non-hazardous confined space can become hazardous if conditions or work practices change.

- If a confined space is identified as being a non- hazardous confined space the employer must:

    - Notify a worker who is required or permitted to enter the confined space that the confined space is not hazardous.

    - Arrange for a method of communication with a worker on entry to and exit from the confined space and at appropriate intervals while a worker is in the confined space.

    - Prepare a procedure for the removal of a worker who has become injured or incapacitated while in the confined space. Workers cannot enter or remain in a confined space unless an effective rescue can be carried out.

    - Ensure that the ventilation in the confined space is adequate to maintain safe atmospheric conditions.

Hazardous Confined Space

- Hazardous confined space means a confined space that endangers or could endanger a worker entering into or already in the confined space due to the:
    - Design, construction or atmosphere of the space.
    - Materials or substances in the space.
    - Work activities or processes used in the space.
    - Any other conditions relating to the space.

For example:

- An atmosphere that is or may be injurious by reason of oxygen deficiency or enrichment, flammability, explosivity, or toxicity.
- A condition or changing set of circumstances within or nearby the space that present a potential for injury or illness.
- The potential or inherent characteristics of an activity which can produce adverse or harmful consequences within the space.

Confined space or a hazardous confined space?
(Note: Signage from site to site may vary)

Is the space enclosed or partially enclosed?

NO

YES

Was the space designed or intended for continuous human occupancy?

YES

NO

Does the space have a restricted means of entry or exit?

NO

YES

NOT a Confined Space

Once determined to be a confined space it should be considered a high risk confined space until proven otherwise.

Could this Confined Space become hazardous to a worker entering it because of?

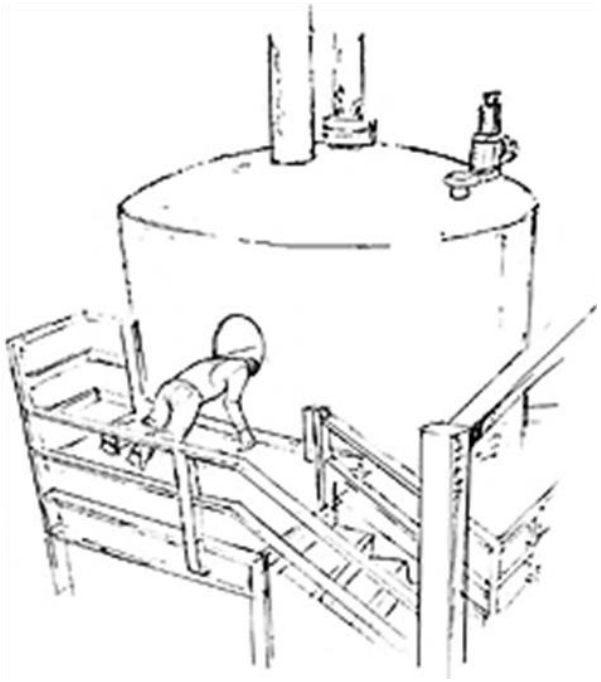
- Design, construction or atmosphere of the space.
- Materials or substances in the space.
- Work activities or processes used in the space.
- Any other conditions relating to the space.

If YES to any of the above.

- The breathing zone is the area within 25cm (~10”) of a person’s mouth and nose

- A worker is considered to have “entered” a confined space when his or her breathing zone crosses the plane of the confined space access.

- Before entering a confined space, ask yourself if entering the confined space is necessary?



Requirements before Non-hazardous confined space entry

- If a worker could be required or permitted to work in a non-hazardous confined space, an employer, in consultation with the safety committee or representative, shall:
    - Identify the types of confined spaces at the work site that the worker could be required or permitted to enter.
    - Identify the types of hazards that are or could be present at each confined space.
    - Identify alternative means to perform the work to be performed in the confined spaces that need not require the worker to enter the confined spaces, and if reasonably possible use the alternative means to perform the work.
    - Identify alterations to the physical characteristics of the confined spaces that could be necessary to ensure safe entrance to and exit from all accessible parts of each confined space that ensure the structural integrity of the confined space is maintained.
    - Ensure a safe means of entry and exit is available to all workers required to work in the confined space.
    - Take reasonable steps to prevent unauthorized entry into a hazardous confined space.
- Workers assigned duties related to the entry must be:
    - Trained to recognize hazards and how to perform their duties in a safe and healthy manner.
    - Knowledgeable in general safety requirements involving the use and availability of personal protective, and emergency equipment, as well as a communication system.
    - Protected from hazards created by traffic in the area of the confined space.
    - In communication with a competent worker, designated by the employer.

Requirements before hazardous confined space entry

- Before a worker is required or permitted to enter a hazardous confined space, an employer shall appoint a competent individual to assess the hazards including:
    - If work activities may result in the release of toxic, flammable or explosive concentrations of substances while workers are in the confined space.
    - If measures have been taken to ensure that the worker will not drown or become entrapped in liquid or free-flowing solid present in the confined space.
    - That the entry of liquid or free-flowing solid or hazardous substance into the confined space in a quantity that could endanger the health or safety of the worker has been prevented.
    - All energy sources that present a hazard to the worker have been locked out, with energy sources being put in a zero-energy state.
    - Any biological hazards.
    - The opening for entry / exit is sufficient to allow safe passage of the worker who is using required PPE.
    - If a potentially hazardous atmosphere has been identified the atmosphere must be tested for:
        - Oxygen enrichment or deficiency.
        - The presence of flammable or explosive substances.
        - The presence and concentration of hazardous airborne chemical substances.
    - When testing the atmosphere, the equipment must be appropriate and properly calibrated and be tested to ensure that the instruments are capable of operating safely and effectively.
    - The above requirements must be documented in a report and include any recommended special precautions, procedures or PPE to reduce the risk to a worker.

Entry Plan

- If a worker will be required or permitted to enter a hazardous confined space, an employer, in consultations with the safety committee, shall develop a hazardous confined space entry plan to ensure the health and safety of workers who enter or work in the hazardous confined space.

- An employer shall make a copy of a hazardous confined space entry plan readily available at the entrance to the hazardous confined space.

- A hazardous confined space entry plan must be in writing and must include:

    - The tests or measurements necessary to monitor for oxygen deficiency or enrichment or the presence and concentration of hazardous, flammable or explosive substances.

    - The identification of other hazards that could be present and could endanger the worker.

    - The means of isolating the hazards.

    - The means of ventilating the hazardous confined space.

    - The procedures to enter, work in and exit hazardous confined space.

    - The availability, location, and proper use of PPE.

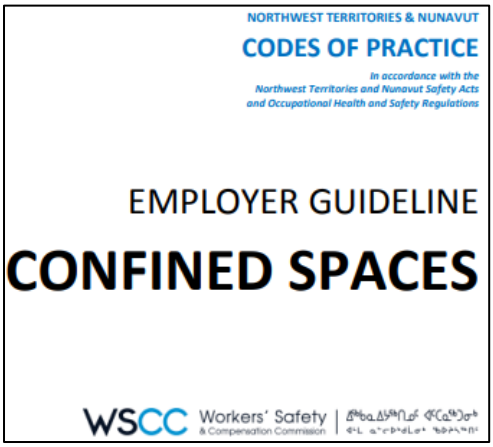
    - The rescue procedures to be followed including the number and duties of personnel and the availability, location and proper use of equipment.

    - The means to maintain effective communication with a worker who has entered the hazardous confined space.

    - The availability, location, and proper use of any other equipment that a worker could need to work safely in the hazardous confined space.

Entry Plan vs Code of Practice

- An entry plan is not a code of practice and does not include some elements of a code of practice.
- An entry plan is mandatory, a code of practice is not mandatory.
- However, a Confined Space Codes of Practice has been produced by the WSCC.
- In legal proceedings failure to observe a code of practice may be a consideration when determining whether a worker complies with the Safety Act and related Regulations.
- You can review the Employer guideline for Confined Space Codes of Practice by clicking on the image



Codes of Practice

- Employers should have a code of practice governing the practices and procedures for workers entering and working in a confined space to ensure that all workers understand the requirements for entering a confined space.

- There are three basic steps in preparing a confined space entry code of practice:
  - Identify all confined spaces at the work site.
  - Identify all hazards in the confined spaces.
  - Develop the code of practice.

- A code of practice should be maintained and periodically reviewed.

- A code of practice should be in writing and available to workers at the work site who are affected by it.

- Workers affected by the code of practice must be familiar with it before work in the confined space begins.

- Workers should be consulted about the content of the code of practice as they often have the best understanding of the hazards involved in the work.

- The help of safety professionals such as industrial or occupational hygienists or engineers may be necessary if the situation is particularly complex.

- A code of practice should include:

  - All existing and potential confined space work locations at a work site and reasons for work requiring confined space entry.
  - All hazards that may be present.
  - The subject matter of each section of the Safety Act and OH&S Regulations that apply to the confined space and the work being done.
  - Who has responsibilities for confined space entry and a general description of how confined spaces are dealt with in your workplace.
  - Who must be trained, the type of training required, and the frequency of training.
  - An entry permit system.
  - Atmospheric testing procedures.
  - Ventilation, purging or inerting procedures.
  - Procedures for isolating hazardous substances or equipment.
  - An emergency response plan.
  - “Monitoring worker” roles and responsibilities.
  - Record keeping requirements.

Training and Information

- Although it is the employers' responsibility for the provision of training, employees are responsible to use that knowledge and participate in any company procedures regarding safety.
- The Northwest Territories and Nunavut OH&S Regulations state that all workers who work within confined spaces and all workers with related duties e.g. rescue workers and tending workers or "safety watch" personnel, must receive training specific to the hazardous confined space entry plan.
- Every worker who works in a confined space must be able to recognize the hazards of working in the space and safely perform assigned duties.
- While the OH&S regulations do not require specific emergency rescue training for every worker, employers should provide their workers with the knowledge necessary to ensure the safe rescue of anyone needing quick removal from a confined space.
- The rescue portion of this training may be part of a company or operation-wide emergency preparedness and response plan.
- Training on its own does not ensure that a worker is competent to safely perform work. In addition to training, a worker must be adequately qualified and experienced to work safely.
- In cases where a worker is new to the job and does not have sufficient experience, the worker must be teamed up with and work under the direct supervision of a competent worker.
- Requirements for worker training will vary depending on the tasks of different workers, but must at least include:
    - Safe work procedures for entry, working in and exiting the confined space.
    - Hazard recognition.
    - Content of the entry permit.
    - How to properly use the control measures in place to protect workers,
    - What to do in the event of an emergency.

Chapter 2 Summary:

What was covered in Chapter 2?

- Employers' and employees' responsibilities as they relate to working in confined spaces.
- The definition of a confined space.
- The process for identifying confined spaces.
- The Northwest Territories and Nunavut Safety Act and Regulations' requirements for confined spaces.
- The Northwest Territories and Nunavut Safety Act and Regulations' requirements with respect to an Entry Plan and Codes of Practice for working in a confined space.
- The 3 steps for preparing a confined space entry codes of practice.
- The minimum training requirements for workers to receive training for confined spaces.

Chapter 3: Hazards Associated with Confined Spaces

Goal:

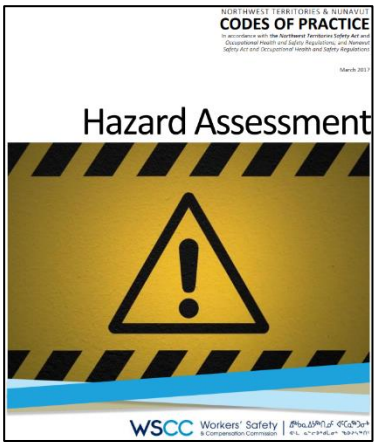
The student should be aware of hazards associated with Confined Spaces.

Objectives:

1. The student should be familiar with the hazard assessment process.
2. The student should be aware of the hazards typically associated with Confined Spaces.
3. The student should be familiar with five elements that should be included in the written procedures for atmospheric testing.

Hazard Assessment

- A Codes of Practice for Hazard Assessment has been produced by the WSCC.
- In legal proceedings failure to observe a code of practice may be a consideration when determining whether a worker complies with the Safety Acts and related Regulations.
- You can review the Codes of Practice for Hazard Assessment by clicking on the image.



- In assessing the hazards that workers are likely to be exposed to, the requirements of Northwest Territories and Nunavut Codes of Practice for Hazard Assessment should be followed.
- The steps for the formal hazard assessment process are as follows:
  - Positions - List what workers do (what are the positions within the company/organization).
  - Tasks - Figure out all the work tasks or activities each position performs.
  - Hazards - Identify the health and safety hazards for each task.
  - Risks - Assess and rank the risk level of each hazard.
  - Control - Determine ways to control (or preferably eliminate) the hazards.
  - Implement - Put controls into place and notify workers.
  - Check-up - Monitor and review to make sure controls are effective.
  - Living Documents - Review and update these documents regularly.

- The employer should have a list of all confined spaces in the workplace.
- The employer should have a qualified person review the list to ensure all the confined spaces have been properly identified.
- For each confined space or group of similar spaces, the qualified person will identify potential hazards and assess the likelihood of each occurring.
- Hazard assessments should be conducted to identify existing or potential hazards before work begins, at regular intervals and when anything changes that could affect the safety of the worksite.
- A report should be filled out listing the results of the hazard assessment.
- Hazards should be assessed for risk prior to any controls being put in place.
- The methods used to control or eliminate the identified hazards must be recorded.
- Once a hazard has been identified, a worker is required to follow safe work procedures to avoid causing damage or injury at the worksite.
- Workers should participate and contribute to discussions:
    - Ask questions of task assignment and how your job fits in with overall job.
    - Discuss your role with supervisor/foreman and co-workers.
    - Develop a work plan that accounts for others' tasks and reduces or eliminates risks to others that could be created by your task's hazards.
    - Assess and discuss specific task and/or site hazards; introduce new information as needed.
- Be alert for changes that may impact your task or those of your co-workers.; if any significant changes are noted, inform your co-workers.

Assess weather conditions.

- If working outdoors, a detailed weather forecast should be assessed each morning.
- It is critical that weather is discussed during the planning sessions.
- Be prepared to adjust tasks, people and/or equipment if weather changes. If a weather change is expected, discuss the potential impact with the crew.

Confined Space Hazards

- A confined space could have any one or combination of chemical, physical, or biological hazards.

- Hazards in confined spaces generally fall within four categories:

    - Safety
    - Work-related
    - Human factors
    - Atmospheric

Safety Hazards

- Entry/exit points (e.g. very small openings, steep ladders, exits at height that could cause falls, exits into traffic or machinery hazard areas).
- Machinery (the worker may be trapped or crushed by drive belts augers, mixers, agitators, conveyor belts, etc.).
- Piping and distribution systems (e.g. steam lines, liquid distribution lines).
- Residual chemicals (e.g. material in a storage tank that is not completely emptied or purged, dry materials that may remain stuck to surfaces).
- Engulfment (workers can be trapped or buried by dry bulk materials such as grain, sand, flour, fertilizer and sawdust).
- Uncontrolled introduction of steam, water or other gas or liquid.
- Electricity (e.g. unguarded energized electrical equipment, motor control centres).
- Visibility (the space may be improperly or inadequately lit).
- Physical obstacles (e.g. cross bracing, baffle plates, piping).
- Walking or working surfaces (e.g. the surfaces may be hot or slippery).
- Traffic around the confined space.
- Temperature extremes (e.g. working in freezers or boilers, areas with steam or heat distribution pipes).
- Humidity.
- Noise (Noise levels can be up to 10 times greater than the same source placed outdoors).
- Vibration (e.g. equipment or tools may cause vibration, such as impact hammers, motors, etc.).
- Radiation (e.g. ultraviolet or infrared sources from welding, cutting or brazing, x-ray systems used for inspection and monitoring).

Work Related Hazards

- Manholes in contaminated ground e.g. near a leaking underground gasoline storage tank, into which poisonous or flammable gases can seep.

- Manholes, pits or trenches connected to sewers, in which there can be a build-up of flammable and/or poisonous gases and/or insufficient oxygen in the air.

- Tanks or pits containing sludge's and other residues which, if disturbed, may partially fill the confined space with dangerous gases.

- Confined spaces that contain rotting vegetation, rusting metal work, and similar natural oxidation processes that create an oxygen-deficient atmosphere.

- Some painting work and the application of certain adhesives, cleaners and liquids such as paint thinners, these can produce dangerous amounts of solvent vapour, which can cause dizziness and impair judgment.

- Solvents are often flammable so there is also a risk of fire.

- Welding activities may generate toxic gases or vapours.

- The use of gasoline or diesel engines can lead to the build-up of poisonous carbon monoxide gas. There is also a risk of fire resulting from leaks.

- Introduction of hot work.

- The filling / emptying of an adjacent compartment / tank.

- Weather changes, such as thunderstorms a drop in barometric pressure, lightning, change in wind direction, etc.

- Heat of the day increasing vaporization and affecting personnel (heat exhaustion).

- Pipes entering the confined space may contain hazardous materials.

- No sandblasting in a confined space can take place without the approval of the Chief Safety Officer, who may impose certain conditions on when work can begin and how it must be done.

  The Chief Safety Officer is appointed by the Workers' Safety & Compensation Commission (WSCC), the Chief Safety Officer supervises and directs all WSCC safety officers in the Northwest Territories and Nunavut in carrying out and enforcing the Safety Acts and related regulations.

Human Factor Hazards

- Some workers may have phobias (e.g. claustrophobia, fear of heights) that could interfere with their ability to work in a confined space.

- The use of bulky personal protective equipment (especially respirators) can also cause heat stress and fatigue.

- The physical condition of workers may also be a factor in cases where there are temperature extremes, or the work is physically demanding.

- As a result, some workers may not be suited for work in confined spaces.

- The employer should consider the physical condition of the workers during the hazard assessment process.

- Fitness-to-work assessments should be done by a qualified professional to ensure it is safe for workers to perform work in a confined space.

Atmospheric Hazards

- Confined spaces can become unsafe as a result of atmospheric hazards such as:
    - Oxygen deficiency or enrichment.
    - Flammable gases
    - Toxic gases
    - Other substances such as animal droppings, mould
- It is important to remember that all gases are chemicals and chemicals are extremely difficult or impossible to detect with human senses.
- The atmospheric hazards of a confined space must be determined by a qualified person after considering:
    - The design, construction, and use of the confined space.
    - The work activities to be performed.
    - Possible effects of all required engineering controls.
- Lack of oxygen is a leading cause of death among workers in confined spaces.
- Normally air contains 20.9% oxygen.
- Workers must not enter a confined space containing less than 19.5% oxygen without taking appropriate precautions which may include the use of breathing apparatus.
- Low oxygen levels cannot be detected by sight or smell, you must test the air for this hazardous condition.
- Common causes of oxygen deficiency in a confined space:
    - Oxygen is used up when metals rust.
    - Oxygen is used up during combustion, for example, by propane space heaters, during cutting or welding, and by internal combustion engines.
    - Micro-organisms use up oxygen, for example, in sewer lines and fermentation vessels.

- Oxygen can be displaced by other gases, for example:

    - Welding gases.
    - Toxic or flammable gases, (e.g. H2S or Methane)
    - Inert gases, for (e.g. argon or nitrogen).

- During purging, an inert gas such as nitrogen is deliberately pumped into a confined space to force out (purge) flammable or explosive vapours or gases.

- When possible, the inert gas is replaced with fresh air before the space is entered.

- Always test the atmosphere to confirm the oxygen concentration, concentration of flammable gases, the presence and concentration of any toxic chemicals.

Chapter 3, Slide 30 - Video – The Effects of a Low Oxygen Atmosphere

Oxygen Enrichment.

- Air is considered oxygen-enriched at levels above 23%.
- Enrichment can be caused by improper isolation of oxygen lines, ventilation of the space with oxygen instead of air, leaks from welding equipment, improper use of oxygen for breathing air.

This is an oxy-acetylene torch flame BEFORE the oxygen is turned on.

- The concern is that an oxygen enriched atmosphere could result in an unpredictable fire or explosion.
- A fire or explosion in an oxygen enriched atmosphere will be spectacular.

This is an oxy-acetylene torch flame AFTER the oxygen is turned on.

To prevent oxygen enrichment, follow these precautions:

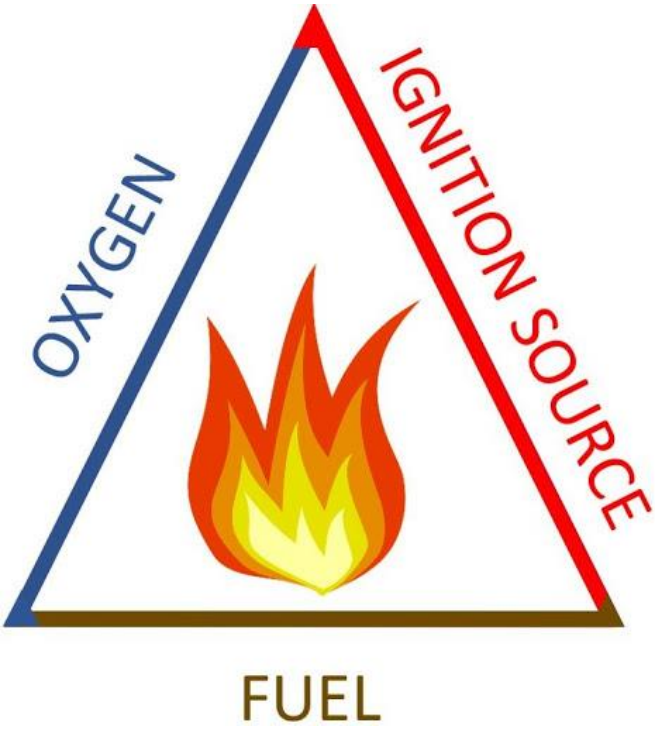
- Isolate the space from any oxygen lines.
- Never ventilate a confined space with oxygen.
- Keep cylinders of oxygen outside the confined space (except for medical emergencies).
- Remove oxyacetylene torches and hoses from the confined space when not in use, whenever practicable.

Oxygen Concentrations	Effects
23% and greater	Increased combustibility of materials.
20.9%	Normal.
19.5%	Minimum for safe working condition.
16%	Rapid pulse, lack of coordination, impaired thinking.
12%	Extremely impaired judgment and coordination. Heart damage.
Less than 10%	Nausea, vomiting, unconsciousness, death.

- Note the difference between a normal oxygen level and an oxygen deficient atmosphere is only 1.4%.

Explosive Gases or Vapours

Three elements are necessary for a fire or explosion to occur:



Oxygen

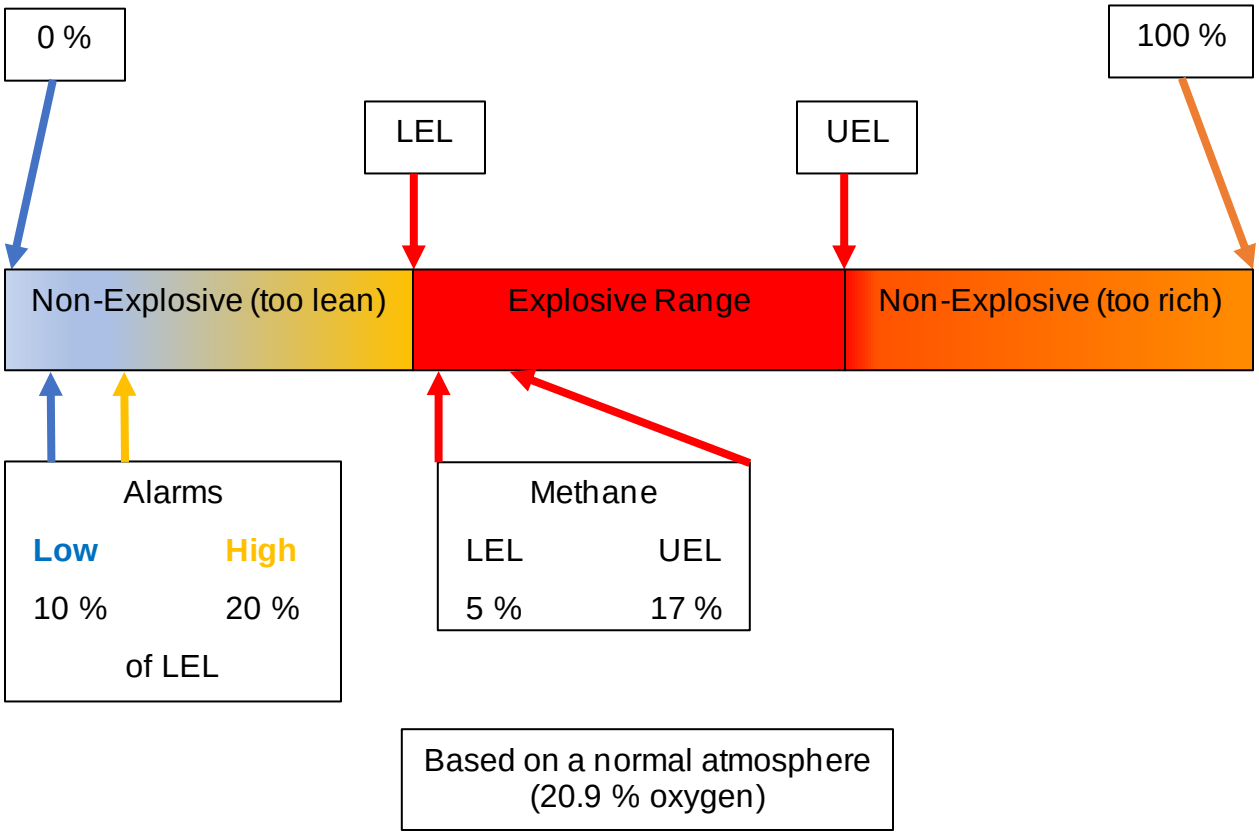
- Combustion requires an oxidizing agent, the most common oxidizing agent is oxygen because of its abundance in the air.
- Air normally contains 20.9% oxygen, enough oxygen for a fire.
- A higher level of oxygen increases the likelihood of material burning.
- Keep in mind in some settings there may be other oxidizing agents present.

Fuel

- Fuel for a fire is any material that can burn.
- Fires and explosions in confined spaces are often caused by gases or vapours igniting.
- Flammable gases such as acetylene, butane, propane, hydrogen, and methane are often common in confined spaces.
- Combustible atmospheres are those in which a fuel is present in quantities sufficient to ignite.
- These concentrations define the “Combustible Range”, otherwise referred to as the “Flammable or Explosive Range”.
- These ranges vary from one material to another.

- The lower limit (LEL or LFL) is the lowest concentration of a gas or vapour that will support combustion and the upper limit (UEL or UFL) is the highest concentration of a gas or vapour that will support combustion.

- Concentrations of gas in the atmosphere less than the LEL (too lean) or greater than the UEL (too rich) will not ignite in a normal atmosphere (20.9% oxygen).



- If a flammable or explosive substance is present in the atmosphere of a work site at a level that is more than 20% of the lower explosive limit of that substance, an employer shall not require or permit a worker to enter into or work at the work site.

  This does not include firefighters or other workers who have been trained according to the requirements of the regulations.

- NOTE: Two or more chemicals may react with each other and become explosive.
- Containers of fuels such as gasoline and propane should not be taken into a confined space as fuel can easily burn or explode.
- Methane gas and hydrogen sulfide gas produced by rotting organic wastes in sewers or tanks.
- Hydrogen gas produced by contact between aluminum or galvanized metals and corrosive liquids.
- Solvents such as acetone, ethanol, toluene, turpentine, and xylene, which may have been introduced into the space through spills or by improper use or disposal.
- A fuel needs to be “primed” or at a minimum temperature before it can ignite.
- Flammable vapour mixtures occur at or above the flash point temperature of the liquid.
- Flammable gas mixtures can form at any temperature.
- Keep in mind as temperatures rise flammable liquids may start to give off vapors, the same applies to liquids being disturbed.

Ignition sources include:

- Open flames
- Sparks from metal impact
- Welding arcs
- Arcing of electrical motors
- Hot surfaces
- Lightning
- Chemical reaction
- Discharge of static electricity

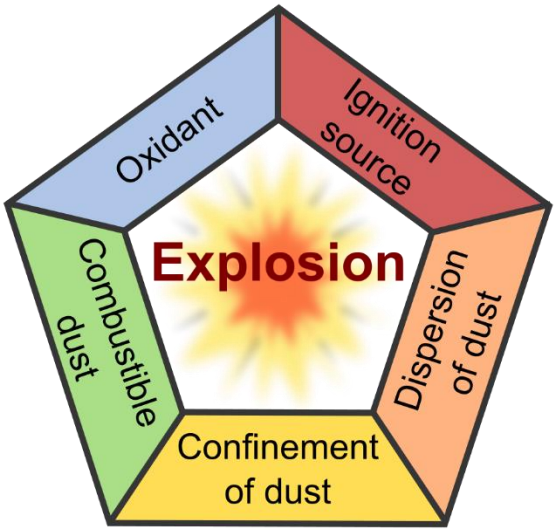
- Many processes can generate static charge, including steam cleaning, purging, and ventilation procedures.

Chapter 3, Slide 45 - Video – No Escape: Dangers of Confined Spaces

Grain dusts, coal dust.

- Grain, nitrated fertilizers, and ground chemicals can produce combustible dusts.

- Coal dust and grain dusts may explode under the right conditions.



Corrosive Atmospheres

- Accumulates from some manufacturing processes, biological or chemical reactions.

- Corrosive substances destroy living tissue.

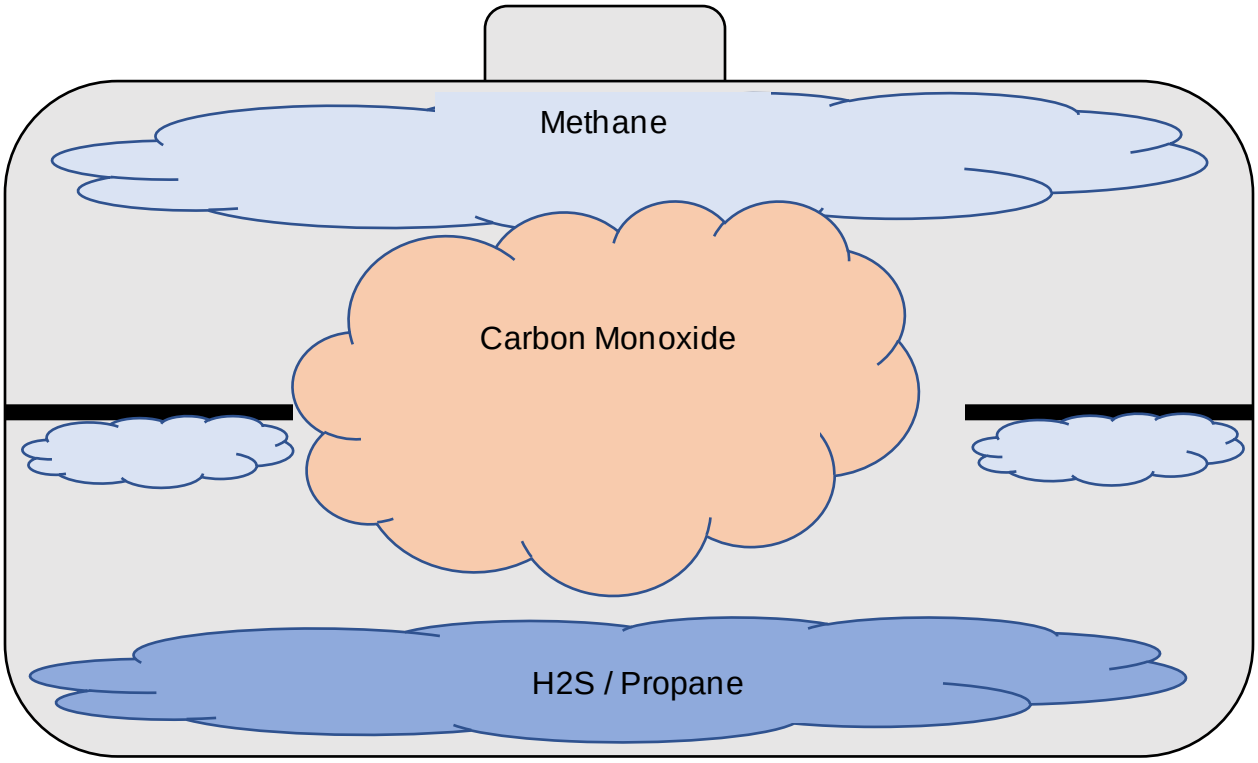
- Some cause immediate damage to skin and eyes; some have no immediate effect but cause cancer with prolonged exposure.

Toxic Gases or Vapours

- Contaminants in the air can result in an atmosphere that is toxic to workers and may result in injury or death.
- These gases/vapours can result from known materials in the work area that have not been adequately ventilated.
- Or they can result from gradual release from sludge or scale inside the confined space.
- Cleaning, painting or welding may produce dangerous vapours or fumes which can be health, fire and explosion hazards.
- Toxic gases like H2S may leak into the space from gas pockets underground.
- Carbon monoxide may be generated or collect in the space due to burning material or the use of an internal combustion engine.
- Liquids may produce hazardous atmospheres if they evaporate — for example, liquid fuel in a tank producing vapours.
- Dangerous conditions can develop when pockets of gas in waste materials are disturbed during cleaning.
- An organic material such as manure sludge can release hydrogen sulfide and methane when manure pits are cleaned out.
- Rotting pulp in tanks also creates hydrogen sulfide. If grains in silos ferment, they use up oxygen and produce deadly gases.
- The concentration of the substances inside the confined space must be determined with a recently calibrated air monitor set up with the correct sensors.
- Such an air monitor may sound an alarm that will alert the worker before the allowable exposure limit is reached.

Vapour Density

- Vapour density is the weight of a gas (vapour) compared to air.
- Air is used as the standard medium and has a vapour density equal of one (1).
- Heavier than air gases will collect in low lying areas:
  - Hydrogen Sulphide (H2S) vapour density is 1.19
  - Propane vapour density is 1.4
- Lighter than air gases will rise:
  - Methane vapour density is 0.6
- Other gases will mix evenly in the air:
  - Carbon monoxide vapour density is .98 at 20 C.
- Lighter than air gases may carry heavier gases up.
- Lighter than air gases may be trapped under baffles or other obstructions.



Key points to remember about gases in a confined space are:

- Identify the potential gases that may be present in the initial hazard assessment.
- Refer to company Safety Data Sheet (SDS) for specific information about those gases.
- Test for the presence and concentration of the gases that were identified in the hazard assessment.
- Harmful substance must be eliminated wherever practicable.
- Take all necessary precautions to protect workers from exposure.
- In most cases, mechanical ventilation such as fans must be used to ventilate the space, bringing in clean outside air.
- Air testing and ventilation are the best ways to ensure that workers are not placed at risk from hazardous atmospheres.
- Remember, conditions may change as the result of work being done or temperature changes.

Immediately Dangerous to Life or Health (IDLH)

- Immediately dangerous to life or health means circumstances in which the atmosphere is deficient in oxygen or the concentration of a harmful substance in the atmosphere:
    - Is an immediate threat to life.
    - May affect health irreversibly.
    - May have future adverse effects on health.
    - May interfere with a worker's ability to escape from a dangerous atmosphere.
    - In most workplaces, IDLS conditions rarely occur. Confined spaces are the exception – IDLH conditions are much more common in sewers or tanks where welding is done or tanks which contained chemicals or fuel.
        - Most chemicals have a listed IDLH level https://www.cdc.gov/niosh/idlh/intridl4.html

Occupational Exposure Limits (OEL)

- Although many contaminants in the air may be toxic, exposure to the chemicals can be legal if they remain below identified levels of concentration for certain periods of time.

- These are known as Occupational Exposure Limits (OEL's).

    - Also known as; Worker Exposure Limits (WEL) Threshold Limit Values (TLV's), or Permissible Exposure Limits (PEL).

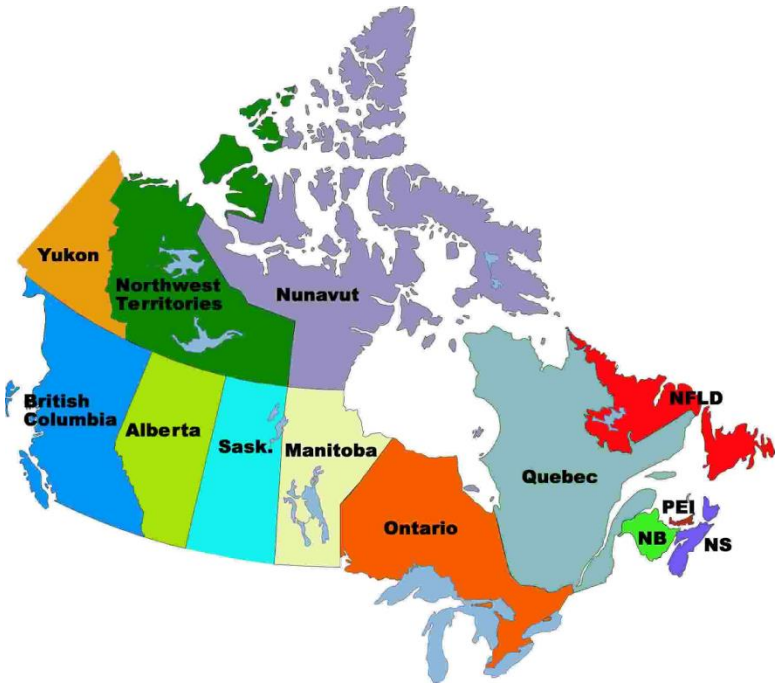
- Schedule O of the Northwest Territories and Nunavut OH&S Regulations identifies the acceptable levels in Northwest Territories and Nunavut.

- Time Weighted Average (TWA) is based on the average exposure to a contaminant or condition to which workers may be exposed without adverse effect over a period such as in an 8-hour day or 40-hour week without wearing respiratory protection.

- Short Term Exposure Limit (STEL) is the fifteen-minute (15) minute Time Weighted Average exposure which shall not be exceeded at any time during a workday.

- Ceiling Exposure Limit is the maximum allowable concentration of a controlled substance.

- Occupational Exposure Limits like many OH&S regulations can vary from jurisdiction to jurisdiction.



Testing the Atmosphere

- Remember all gases are chemicals and most are not detectable with human senses, you need the right tool to keep you safe.
- One of the most important requirements for keeping a confined space safe is having an accurate and reliable gas detection system and gas monitors and knowing the difference.

Gas Monitor

- A gas monitor is different from a gas detector.

- One of the most important differences is that a monitor can be portable, allowing workers to clip them onto their clothing when heading to work in an area that might have gas leaks.
- Many of the monitors are personal-use ones, and the addition of them to your commercial building can be a great benefit to your employees.
- There are some monitors that are especially designed to monitor one particular kind of gas, such as carbon monoxide, while others run the gamut of what they can detect.
- Typically, a personal gas monitor will have 4 sensors; oxygen, LEL, and 2 toxic gas sensors (H2S and Carbon monoxide) however more importantly is that the sensors that are required for the hazards that may be present have been installed.
- These devices are easy to use and light, allowing workers to carry them around as they work.
- They should be worn in the breathing zone

Gas Detector

- A gas detector is a device that will alert you if there is a gas present (provided you have the correct sensor).
- It is usually a device that is part of a greater alarm system which sends a warning in the form of an alarm to warn anyone in the area to leave.
- Gas detectors come in many different sizes and types, offering you a choice when you start looking for devices to purchase.
- There are different types for different gases (e.g., infrared, ultrasonic systems).
- These detectors can be used to detect toxic, flammable, and combustible gases as well as oxygen depletion levels.

Common Errors in Atmospheric Testing

- Have the right equipment for the job, do not use a monitor as a detector unless the manufacturer has indicated it has been designed for those specific purposes.
- If the sensors on the test equipment do not test for all the contaminants identified in the hazard assessment, then additional monitoring equipment appropriate for the contaminants and conditions must be used.
- When you turn your monitor on it will automatically zero, to ensure accurate and reliable readings before zeroing you must be certain that your environment is free from contaminants.
- Competent workers must conduct the testing with suitable test equipment that has been properly calibrated and is used in accordance with the manufacturer's specifications.
- You must be trained on the specific equipment that you will be using.
- You must follow the equipment manufacturer's instructions for proper use, but you must also have policies and procedures specific to your workplace.

- Sensors for detecting combustible gases need oxygen to provide an accurate reading, if the oxygen concentration in an environment is below 10 percent, the sensor will not function properly, and a dangerous condition may go undetected.

- It is particularly important for the individuals performing these tests to understand the limitations of the test equipment.

- The worker needs to ensure adequate levels of Personal Protective Equipment is used to protect them from what may be discovered.

- The employer must ensure that as often as necessary after the first time a worker enters the confined space, a competent worker performs the tests the atmosphere frequently enough to ensure the workers are not exposed to gases above legal limits.

Bump Test

- A bump test is a brief exposure of the monitor to gas in order to verify that the sensors respond and the instrument alarms function accordingly, the bump test does not check the accuracy of the instrument.

- Perform a “bump” (function) test before use.

Bump test using a docking station.

Manual Bump test

- A bump test is not a calibration it only let’s you know if the alarm will activate at the set point.

- A calibration check is performed by exposing the monitor to a certified concentration of gas for a particular time to verify that it provides an accurate reading.

- Monitoring equipment must be calibrated according to the frequency specified in the manufacturer’s instructions and must be bump tested or spanned as required prior to use.

Minimum Requirements

- Testing should be done in accordance with the code of practice developed by the employer that should include:
    - What to test for.
    - Testing initial conditions.
    - Continuous monitoring.
    - Proper test procedures and equipment for when and where to test

What to Test For:

- Before entering a confined space that may contain a hazardous atmosphere e.g. oxygen deficient or containing toxic or explosive substances, pre-entry atmospheric testing must be done to ensure that levels of oxygen are adequate, and the concentration of any hazardous substance is identified.

Testing Initial Conditions:

- Test before opening access to the space, or if not possible, immediately after the space has been opened. (use appropriate PPE).
- If it is not possible to test before opening the space, do pre-entry testing before any ventilation is applied to the space.
- Testing must be conducted to verify that the required precautions have been effective at controlling the identified hazards and that the atmosphere is safe for a worker to enter a confined space.

Continuous Monitoring

- Situations may arise in which the atmosphere within a confined space, or the concentration of an airborne substance(s) within a confined space, can change unpredictably.

- An employer must ensure continuous monitoring of the atmosphere if a condition in the confined space could change and put the workers' health or safety at risk.

- If a wide enough margin of safety is applied to the alarm settings, the alarm can be used to indicate that workers must leave the space.

- The Code of Practice should ensure appropriate monitoring equipment is used for contaminants whose concentrations could exceed the protection provided by respirators.

Proper test procedures and equipment for when and where to test.

- Where gases maybe trapped.

- At hazard points during line disconnect or other isolation procedures.

- Before workers re-enter a space after it has been vacated for more than 20 minutes.

- Before and after procedures such as cleaning and purging.

- When there is a change in work.

- During work that causes contaminants to be generated in the workspace.

- If a change of atmosphere is suspected or it is possible that control measures cannot or do not ensure a safe atmosphere.

- If a hazardous substance is accidentally released into the confined space.

- If a worker indicates symptoms of exposure to air contaminants, for example a "light-headed" feeling, headache, a choking or coughing feeling, nausea, burning or fogging eyes.

- If ventilation fans have been shut down for any reason.

- If ventilation is used to reduce or eliminate a hazard an employer shall ensure that a competent individual tests the atmosphere to determine that the confined space is safe for entry by workers:

    - Before workers enter the confined space

    - Before workers enter a vacant confined space.

    - Before any worker re-enters the confined space on the request of a worker who is required or permitted to enter the confined space.

Chapter 3 – Slide 82 – Video – Sullivan Mine, Kimberly BC

Chapter 3 Summary

What was covered in Chapter 3?

- The hazard assessment process.
- Hazards typically associated with Confined Spaces.
- Five elements that should be included in the written procedures for atmospheric testing.

Chapter 4: Controlling Confined Space Hazards

Goal:

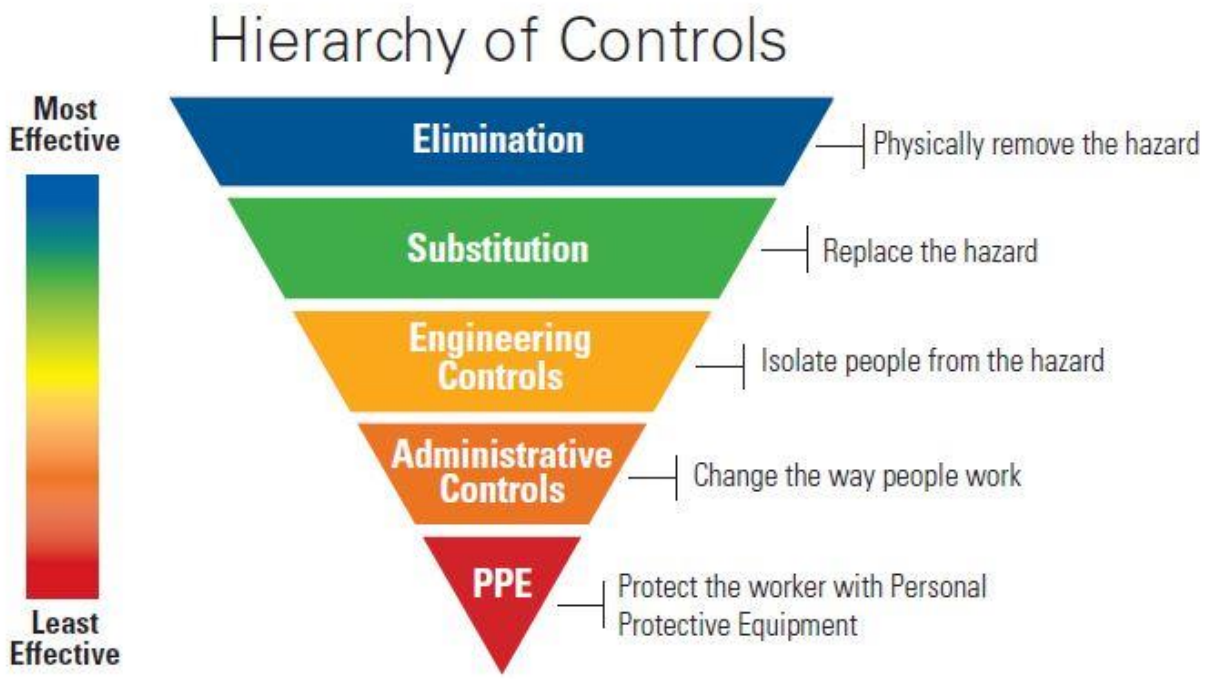
- The student should understand how to evaluate and identify proper hazard controls associated with a Confined Space.

Objectives:

1. The student should be familiar with the hierarchy of controls and how it is applied.
2. The student should be familiar with controls used for hazards in confined spaces.

Hierarchy of Hazard Controls

- When a hazard has been identified and the risk assessment completed controls may be put in place beginning with the most effective control.



Source: NIOSH

- For every confined space, the employer must evaluate each hazard that workers may be exposed to.
- For each hazard, the employer must identify the controls used to protect workers.
- Each control must be assessed for hazards (e.g. inerting may displaces air leaving an oxygen deficient atmosphere).
- Mechanical ventilation may be provided to improve the air quality in the space, or workers may be required to use particular tools or protective equipment.

- The employer must designate a trained and competent person to evaluate the hazards and recommend control options.

- A qualified person must prepare a hazard assessment for each confined space (or group of similar spaces) and for the work activities to be performed.

- The qualified person must have training and experience in recognizing, assessing, and controlling the hazards of confined spaces.

- The qualified person will prepare a hazard assessment and develop written procedures to eliminate or minimize all the hazards likely to prevail.

- Once the assessment has been done for a specific activity within a particular space or group of similar spaces, it may provide the basis for procedures for every occasion when workers enter those spaces.

Controlling the Atmosphere

- If it is known or shown by pre-entry testing that a confined space does not contain clean breathable air, the hazard must be eliminated or controlled before workers enter the space.

- If the confined space has an oxygen-deficient or toxic atmosphere, the first control measure is to replace the atmosphere with air that is safe to breathe.

- The next step is to ensure the air remains safe while workers are inside.

- Even if the air tests as clean and breathable, further controls (such as ventilation) may be needed to ensure the atmosphere remains safe.

- If the atmospheric testing identifies that a hazardous atmosphere exists or is likely to exist in a confined space, an employer must ensure that the confined space is ventilated, purged or both, or inerted before a worker enters the confined space.

- If ventilating or purging a confined space is impractical or ineffective in eliminating a hazardous atmosphere, the employer must ensure that a worker who enters the confined space uses personal protective equipment appropriate for the conditions within the confined space.

- The code of practice should contain a description of when ventilation, purging or inerting are required and the specific procedures and materials to be used.

- The control measures depend on the hazard, for example:
    - If the atmosphere is oxygen-deficient, be sure the space is clean and replace the atmosphere with clean breathable air.
    - If there is, or there is a possibility of a toxic atmosphere from work inside the space, be sure the space is clean, and remove the contaminants and replace the atmosphere with clean breathable air.
    - If the atmosphere is explosive or flammable, be sure the space is clean and replace the atmosphere with clean breathable air or fill the space with an inert gas.
- The atmosphere must be retested after any of the above procedures are used to clean the atmosphere.
- The goal is to ensure that the space contains clean breathable air before a worker enters (except in the case of deliberately inerting the atmosphere).

Precautions if a Safe Atmosphere is not Possible

- If a hazardous confined space cannot be purged and ventilated to provide a safe atmosphere or a safe atmosphere cannot be maintained an employer shall ensure that work is not carried out in the confined space unless it is carried out in accordance with the following requirements.
    - An employer shall ensure that a competent individual continuously monitors the atmosphere in a hazardous confined space.
    - An employer shall ensure that a worker is provided with and required to use a respiratory protective device that meets the requirements of the regulations if:
        - The airborne concentration for a substance meets or exceeds the permissible contamination limit set out in Schedule O.
        - The oxygen deficiency or enrichment is detected.
        - The airborne concentration of any other substance could be harmful to the worker.

Ventilation

Venting

- Venting is the opening up of a confined space to allow clean air to enter and circulate without the use of mechanical ventilation.

- Use of this method as a means of controlling contaminants can be authorized only by a trained and competent person and never for a space with a high or medium-hazard atmosphere.

Ventilating

- Ventilating means the active movement of air using mechanical devices, such as air movers, fans, and local exhaust systems to force fresh air into a confined space.

- It may bring clean air into a space or exhaust contaminated air out of the space.

- Confined spaces must be continuously ventilated to control hazardous atmospheres, except for certain low-hazard atmospheres, inert atmospheres, and in emergency rescue.

- The specific procedure written into the Code of Practice will determine the amount of air required to make a confined space safe prior to entry and while workers are inside the space.

- If mechanical ventilation is required to maintain a safe work atmosphere within a confined space, the employer must ensure that the ventilation system incorporates a method of alerting workers if the system fails.

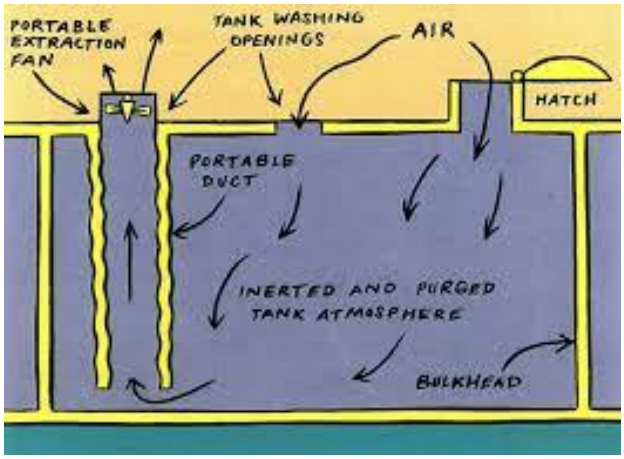
- Workers must be trained in the evacuation procedures to be used if the ventilation system fails.

Mechanical Ventilation

- The two main types of mechanical ventilation are Local exhaust ventilation and General ventilation.

Local exhaust ventilation

- Local exhaust ventilation uses exhaust fans or ducts to remove contaminated air at its source before it has a chance to spread throughout a confined space.
- Local exhaust ventilation is useful where air contaminants are generated from a point source, for example, at a waste sump during welding or during concrete grinding operations.
- Local exhaust ventilation is generally used to supplement general ventilation.

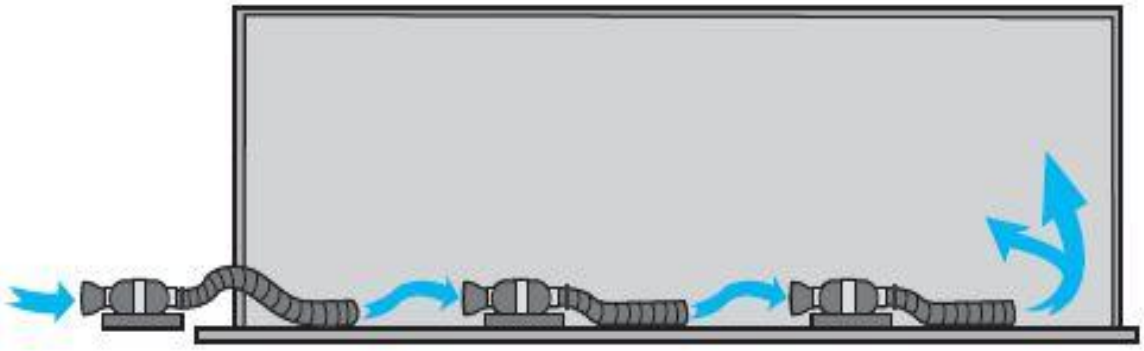


General ventilation

- General ventilation uses mechanical equipment such as fans, blowers, and ducting to deliver clean air into a space or to remove contaminated air from a space.
- General ventilation is sometimes referred to as “dilution” ventilation or positive-pressure ventilation.
- When air is blown into a space, air currents are created and the outside air mixes with air in areas that might normally have stagnant air.
- The faster the air moves the more air mixing will occur, As the mixed air exits the space, contaminants are carried out.
- Ventilators that draw air out of a space minimize air currents and therefore reduce the possibility of generating dust.

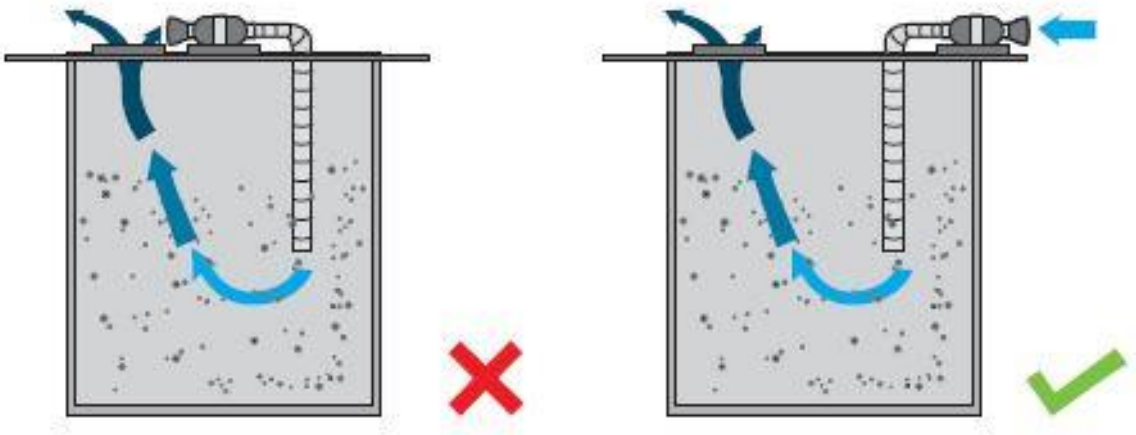
Ventilations systems must be effective and should be set up with the following considerations:

- To ventilate a long space, you may need a ventilator that draws air out at one end and another ventilator that pushes air in at the opposite end.

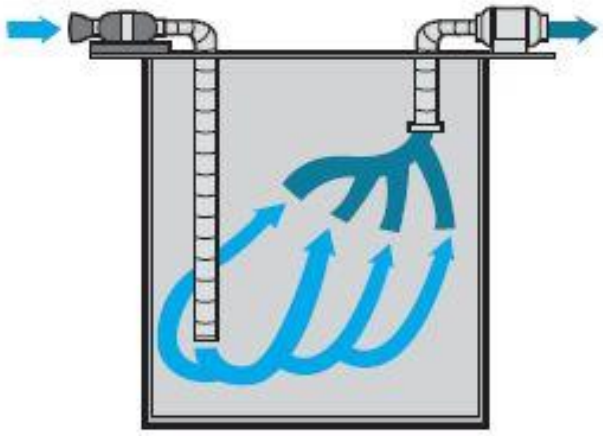


- For a deep confined space the fresh air is blown into the bottom, and the contaminated air is being exhausted near the top.

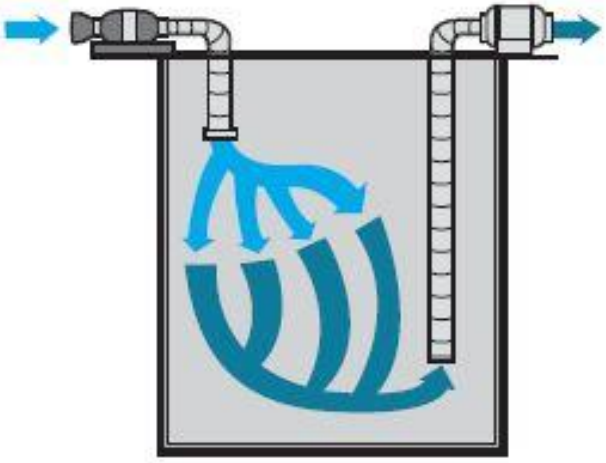
- Prevent the recirculation of exhaust air.



Removing lighter than air contaminants.



Removing heavier than air contaminants.



- There are two types of air-moving devices commonly used to purge or ventilate confined spaces, fans and Venturi eductors.

Fans

- Fans are usually electrically powered and can be divided into two main types: axial and centrifugal.
- Generally, axial fans are used for higher flow rates in systems with lower resistance.
- Centrifugal fans are used for lower flow rates in systems with higher resistance.

Eductors (also known as air horns, air blowers, and air ejectors)

- Eductors operate with compressed air on the principle of the venturi effect.
- Eductors have the advantage of fitting into small openings and have no moving parts.
- Usually, they are unable to move large volumes of air.
- A sufficient volume of compressed air and enough pressure are needed to achieve desired flow rates.

Natural ventilation

- Natural ventilation is ventilation of a space by natural air movement resulting from wind or convection currents.
- Using natural ventilation is <u>prohibited</u> in the following situations:
    - If a confined space has a high or medium risk atmosphere.
    - If natural ventilation could draw air other than clean breathable air into the confined space.
- In limited situations, natural ventilation is acceptable on its own, however it is typically used to supplement mechanical ventilation.

- The Code of Practice should provide written work procedures that identify where and when natural ventilation can be used to maintain clean breathable air in a low-hazard atmosphere, under these circumstances, the air flow must be monitored.

- In addition to continuously measuring the amount of air that is flowing through the space, workers must continuously monitor the atmosphere using a gas monitor to make sure the space contains clean breathable air.

Purging and Inerting

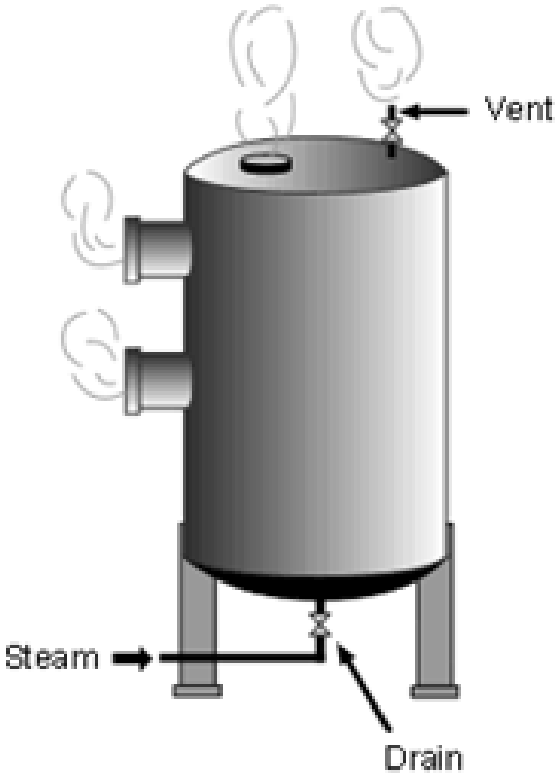
Purging

- Purging is removing (flushing) an unsafe atmosphere from a confined space and replacing it with clean breathable air prior to worker entry.

- This is commonly accomplished by blowing air into the confined space using portable mechanical ventilators.

- Purging can also be accomplished by introducing substances such as an inert gas, steam or water to displace or flush out contaminants.

- Purging is most effective if there are no contaminants being generated within the space. If there are contaminants, the space must first be cleaned and then purged.



- Even though ventilators are used for ventilating and purging, ventilation starts at the point the atmosphere in the space is clean and the ventilator is maintaining fresh air.

- If a concentration of a toxic, flammable or explosive substance is present or an oxygen enrichment or deficiency exists in a hazardous confined space, an employer shall ensure that the hazardous confined space is:
    - Purged and ventilated before a worker is required or permitted to enter the space, so that any hazard associated with a toxic, flammable or explosive substance is reduced to the extent that is possible or eliminated.
    - An oxygen content of between 19.5% and 23% is assured.
    - Continuously ventilated while the worker occupies the hazardous confined space, to maintain a safe atmosphere.

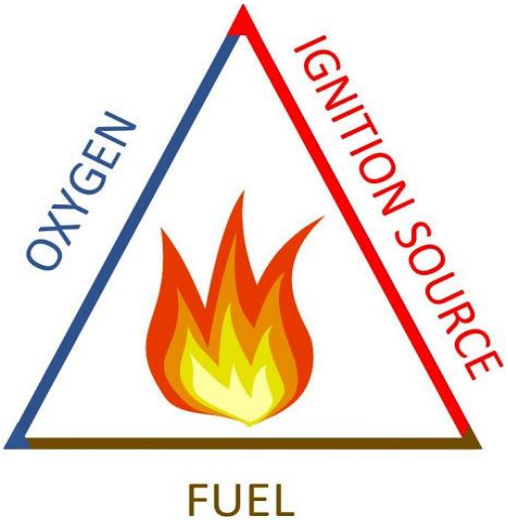
Inerting

- Inerting means the introduction of an inert (unreactive) gas such as nitrogen into a confined space to completely displace all oxygen.
- For a flammable mixture to burn or explode, a source of oxygen and a source of ignition are required.
- Inerting is a technique that is used to remove oxygen from the air.
- A confined space with an inert gas is deadly.
- The following requirements are essential:

    - All entry precautions for high-hazard atmospheres must be followed, except the requirement for continuous ventilation.
    - Every worker entering the confined space must be equipped with an SCBA or a supplied-air respirator equipped with an escape bottle.
    - Respirators must meet the requirements of the Occupational Health and Safety Regulation.
    - The atmosphere inside the confined space must remain inerted while workers are inside.
    - In the event the inert blanket is inadvertently lost, all ignition sources must be controlled.
    - Escaping inert gas must not cause a hazard outside the confined space.

Preventing Fires and Explosions

- Fire prevention requires control of one or more of the three elements needed for a fire or explosion: flammable substances, oxygen, and a source of ignition.



Controlling Flammable Substances

- When a space contains or may contain flammable substances, the qualified person will consider the following when developing the written work procedures:
- Minimizing quantities of flammable materials inside the space at all times.
- Isolating the confined space from flammable substances.
- Cleaning all flammable residues prior to entry.
- Using non-flammable cleaning solvents where possible.
- Controlling any flammable materials that must be used.
- Keeping cylinders of acetylene, propane, and other flammable gases outside the confined space.
- Wetting down spontaneously combustible residues before removal.
- Maintaining the atmosphere as far below 20% of the LEL as possible.
- Checking welding and cutting hoses.
- Removing oxyacetylene welding torches and hose assemblies from confined spaces when not in use, whenever practicable.
- Checking the other side of the surface for other workers or for combustible materials before using a torch or similar welding equipment on walls, bulkheads, etc.

Controlling Sources of Ignition

- If flammable or explosive dusts, gases, vapours or liquids are or could be present in a hazardous confined space, an employer shall ensure that all sources of ignition are eliminated or controlled.

- An employer shall ensure that equipment necessary to rescue workers is readily available at the entrance to the hazardous confined space and used in accordance with the rescue procedures.

- The holder of a Level 1 first aid qualification certificate must be available to provide immediate first aid.

- Personnel who are trained in the rescue procedures and who are fully informed of the hazards in the confined space must be readily available to assist in a rescue procedure.

- Use electrical equipment and lighting approved for hazardous locations.

- Use intrinsically safe air-testing and communications equipment, cameras, or any other equipment used in the space.

- Prohibit cigarettes, matches, and lighters.

- Do not use heaters in a confined space.

- Bond steam nozzles and ventilation systems to metal structures and ground the structures.

- Use non-sparking or low-sparking tools.

- Wear non-sparking footwear (that is, no exposed shoe nails).

- Do not use internal combustion engines in the confined space unless they are approved in the written procedures (through the use of appropriate control measures).

- Where practicable, torches and hoses used for welding, brazing, or cutting must be removed.

Isolation of Physical Hazards

- The purpose of isolating a confined space is to keep all hazards away from workers in a confined space. Isolation procedures should protect workers from:
    - Entrapment. (Loose and unstable material)
    - Moving parts of machinery.
    - Substances entering through piping.
    - Electrical shock.
    - Stored energy.

- Isolation is a process used to stop the flow of energy or any other hazard.
- When a worker is in a confined space, uncontrolled energy sources and hazardous substances must be prevented from creating a hazard to workers.
- Consequences of not properly controlling hazards inside of a confined space are often more severe than the failure to control a hazard in a non-confined space situation, and for this reason a confined space generally requires isolation that is more effective than normal lockout.
- Examples of appropriate controls include blanking or blinding, double blocking and bleeding, misaligning or removing sections of lines, pipes or ducts, controlling all sources of hazardous energy, de-energizing equipment and immobilizing or disconnecting all mechanical linkages.
- In certain cases, alternate means of isolation and safe work procedures, certified by a professional engineer, may be used to protect workers.
- Physical hazards must be identified and controlled to make sure the space is safe for workers to enter.
- An employer must ensure that workers within a confined space are protected against the release of hazardous substances or energy that could harm them.

- The Code of Practice and Hazard Assessment should identify all physical hazards and should have provided the required precautions and written procedures to control those hazards (including lockout and isolation).

- The supervisor of the entry must verify that all required precautions are in place before any worker enters a confined space.

- There are many types of physical hazards, including crushing hazards, heat and cold stress, radiation, vibration, and noise.

- Confined spaces with a hazard of entrapment or engulfment and any situations requiring lockout or isolation procedures should be considered a very serious hazard and in these cases an entry permit should be required.

Entrapment

- A risk of engulfment or entrapment requires the highest level of standby emergency service.
- Whenever there is a danger of entrapment or engulfment, do not enter unless necessary.
- If entry is necessary, a competent person must provide a written procedure.
- The written procedure should consider the following:
    - Inspection prior to entry.
    - Use of kickers or probe bars to dislodge bridges and hung-up material prior to entry.
    - De-energization and lockout of all operating process equipment inside the confined space prior to entry.
    - Isolation and/or lockout prior to entry to prevent engulfment.
    - Requirement for lifeline and harness and provision for immediate rescue of a worker in distress.
    - Other protective equipment that may be needed, such as personal flotation devices or fall protection.
    - If entrance to a hazardous confined space is from the top an employer shall ensure that a worker uses a full-body harness and, if appropriate, is attached to a lifeline.
    - If a lifeline is used, the lifeline must be attended by another worker who is adequately trained in the rescue procedures.

    - If reasonably possible, a mechanical lifting device is available to assist with a rescue and is located at the entry to the confined space while a worker is in the confined space, or an employer shall ensure that an alternate method of rescue is developed and implemented if the use of a full-body harness or lifeline would create an additional hazard.

- Where workers could be exposed to danger from falling objects, follow these requirements:

    - Schedule work activity so that no worker is working above another.

    - Provide suitable protection from overhead hazards.

    - Provide workers with safety headgear.

    - It is the employer's responsibility to provide the required personal protective equipment and ensure that workers are trained to use it.

Hazardous Energy

- Hazardous energy is any electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other source of energy that could potentially injure a worker (e.g. machinery or equipment with moving parts has mechanical energy, and steam in a pipe has thermal energy).

- All hazardous energy at the location at which the work is to be carried out must be isolated by activation of an energy isolating device and the energy isolating device is secured in accordance with OH&S regulations as designated by the employer.

Lockouts

- Confined spaces having any moving parts and electrical power sources must be isolated by locking out and tagging the power source to prevent accidental reactivation.

- Lockout means the use of a lock or locks to render machinery or equipment inoperable or to isolate an energy source in accordance with a written procedure.

- Locks are generally used to prevent the inadvertent start-up or movement of machinery and equipment.

- Lockout is a two-step process.

- The first step is isolation, usually by misaligning a line, setting a switch in the up or down position or closing a valve.

- The second step is to affix a lock to the isolating device in order to prevent others from removing or changing the isolation.

- Affixing a personal lock is a very important step to ensure that the device controlling the energy or other hazard remains in its set state or position.

- To ensure that there is no inadvertent release of energy or energization, the energy isolating device(s) must be physically secured in the isolating position.

- A securing device is anything such as a personal lock that holds an energy-isolating device in its off or safe position.

- The device must be “positive”, meaning that once secured into position, it cannot fall off or allow the energy-isolating device to move from its off or safe position.

- A dowel rod placed in a valve handle, duct tape across a circuit breaker or a sign placed above a box containing fuses that have been removed from an electrical panel would not be “positive” securing devices.

- The securing device or mechanism must be strong enough to withstand inadvertent opening without the use of excessive force, unusual measures, or destructive techniques e.g. metal-cutting tools.

- The employer’s lockout program will outline the procedures required to make each confined space in the workplace safe to enter.

- The supervisor of the entry must ensure that all lockout precautions are in place before a worker enters a confined space.

- An entry permit should be required for all spaces that require lockout.

- Occupational Health and Safety lists when lockout is required and the required lockout procedures.

- Once all energy-isolating devices have been activated to control hazardous energy an employer must ensure that a worker involved in work at each location requiring control of hazardous energy secures each energy-isolating device with a personal lock.

- Once each energy-isolating device is secured the worker must verify that the hazardous energy source has been effectively isolated.

- If more than one worker is working at each location requiring hazardous energy to be controlled each worker must attach a personal lock to each energy-isolating device.

- The first worker applying a lock must verify that the hazardous energy source has been effectively isolated.

Piping Discharging Hazardous Substances

- If a worker could be required or permitted to work in a confined space into which piping could discharge a hazardous substance, an employer shall ensure that the piping:

    - Has a blank installed that is sized for the proper pressure in the piping before the piping enters the confined space.

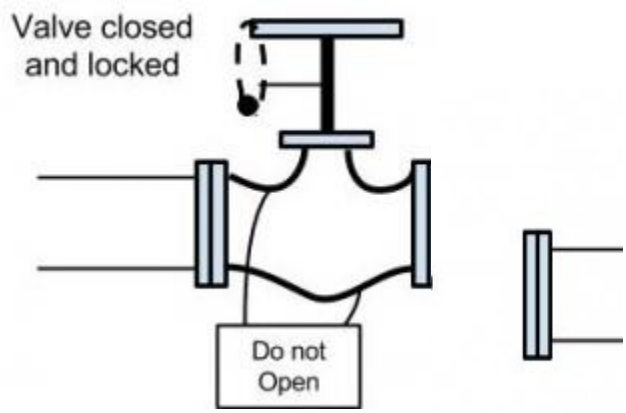
    - Is equipped with two blocking valves and a bleed-off valve installed between the blocking valves located so that bleed off does not contaminate the confined space, or is equipped with an approved safety device.

- If piping is equipped with two blocking valves and a bleed-off valve or an approved safety device, an employer shall ensure that the valves in the flow lines are locked out in the "closed" position and the bleed-off valve is locked out in the "open" position.

- The valves must be tagged to indicate that the valves must not be activated until the tags have been removed by a worker designated by the employer for that purpose.

- The designated worker must monitor the valves to ensure that they are not activated while a worker is in the confined space, and records on the tag, the date and time of each monitoring and signs the tag each time the worker monitors the valves.

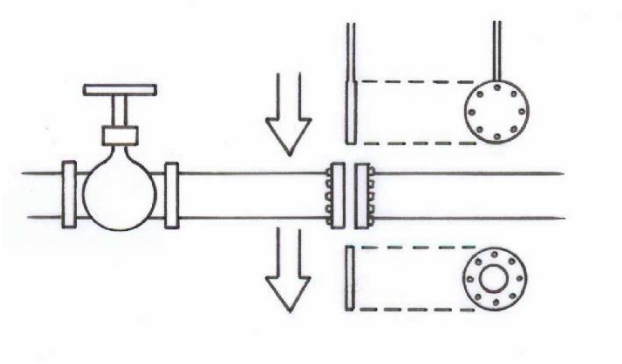
Disconnecting and misaligning a Pipe



- Isolating includes disconnecting a pipe, which can be done by removing the bolts that hold the pipe flanges together or by loosening unions that connect threaded pipe sections.

- If the piping will be left disconnected, the sections of the pipe that have been disconnected also must be misaligned to prevent overflow material from getting into the space.

Blanking / Blinding



- Blanking involves inserting a physical barrier through the cross-section of a pipe so that materials are prevented from flowing past that point.

- Blinding involves disconnecting a pipe and attaching a physical barrier to its end so that materials are prevented from flowing out of the pipe.

- A blank or blind must be:

    - Designed with an allowance for corrosion if it will be used in conditions where it can corrode.

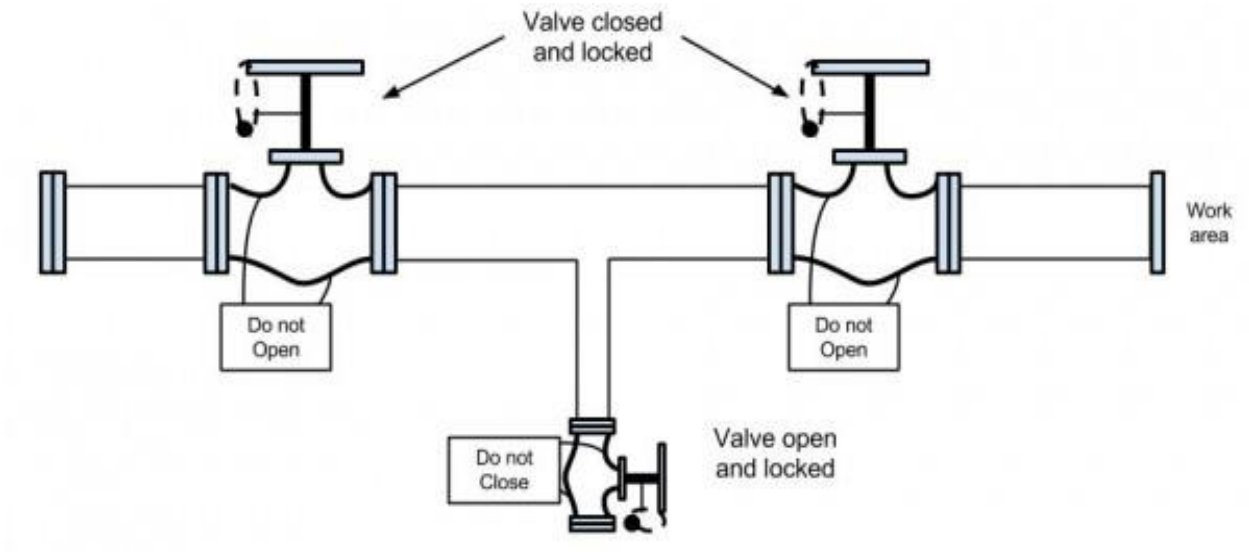
    - Stamped with its pressure rating or otherwise indicate its pressure rating.

- Generally, isolation is achieved by severing or blocking all product lines leading to and from the confined space.

- Typically, a “spectacle” is used as a visual indication that a blank has been installed.

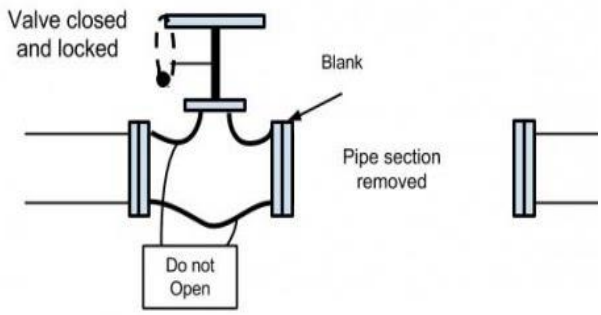
Double Block and Bleed

- Double blocking and bleeding involve use of a three-valve system where a pipe has two closed valves and an open drain valve positioned between them so that material is prevented from flowing and is re-directed in case of a valve leak.
- The valves of a double block and bleed system need to be locked.
- Block and lock the valves on either side of the drain valve.
- Lock the main valves closed and the drain valve open.
- A double block and bleed system is used if the harmful substance in the piping is NOT one of the following:
    - A gas.
    - A vapour.
    - A liquid volatile enough to produce a hazardous concentration of an air contaminant from the discharge from the piping.



Removal of a Valve or ‘Spool Piece’

- A Spool Piece is a short segment of pipe this is usually intended to be removed, either for service or as a stand-in for a valve or other fixture to be installed later.



Electrical Shock

- Electrical tools and equipment used in a confined space must be grounded or double-insulated and so marked.

- If wet or damp conditions exist inside the confined space, electrical tools and equipment must be protected by an approved ground fault circuit interrupter or other acceptable means of protection.

- It is always better to substitute equipment that will not be hazardous inside the confined space.

Pneumatic Tools

- In some cases, the potential for electrical hazards can be eliminated by substituting pneumatic equipment such as air-driven grinders and sanders.

- If these pneumatic tools present a risk of exposure to hazardous contaminants from the exhaust, the compressor system must be located in an area where the exhaust will not contaminate the air inside the space.

- If other utility lines are being used adjacent to the confined space (for example, lines containing gases such as nitrogen, acetylene, or oxygen), precautions must be taken to prevent the pneumatic tools from being attached to those lines.

Grounded Tools

- Properly grounded hand tools are equipped with a means of directing a ground fault back to the service entrance panel where it will blow a fuse or trip a circuit breaker.

- If properly grounded tools are not used, the resulting shock could be severe or even fatal.

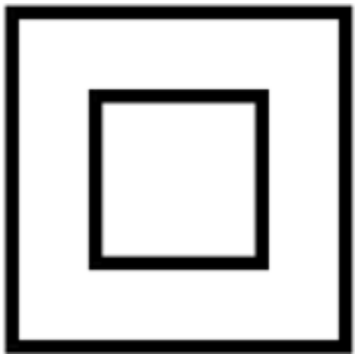
- A three-pronged plug or the wider spade terminal on the machinery/tool or the extension cord plug ensures that ungrounded devices (such as double insulated tools) are plugged in with the correct polarity.

- Never remove the ground pin (third prong) from the cord of a tool or three prong extension cord.

- This ground pin provides grounding protection and it also ensures that double insulated tools are plugged in with the correct polarity.

Double-Insulated Tools (Class II)

- Double-insulated tools are housed in a non-conductive plastic casing with a non-conductive on-off switch, which prevents the operator from coming in contact with any metal parts.



Symbol for double insulation.

Ground Fault Circuit Interrupter (GFCI)

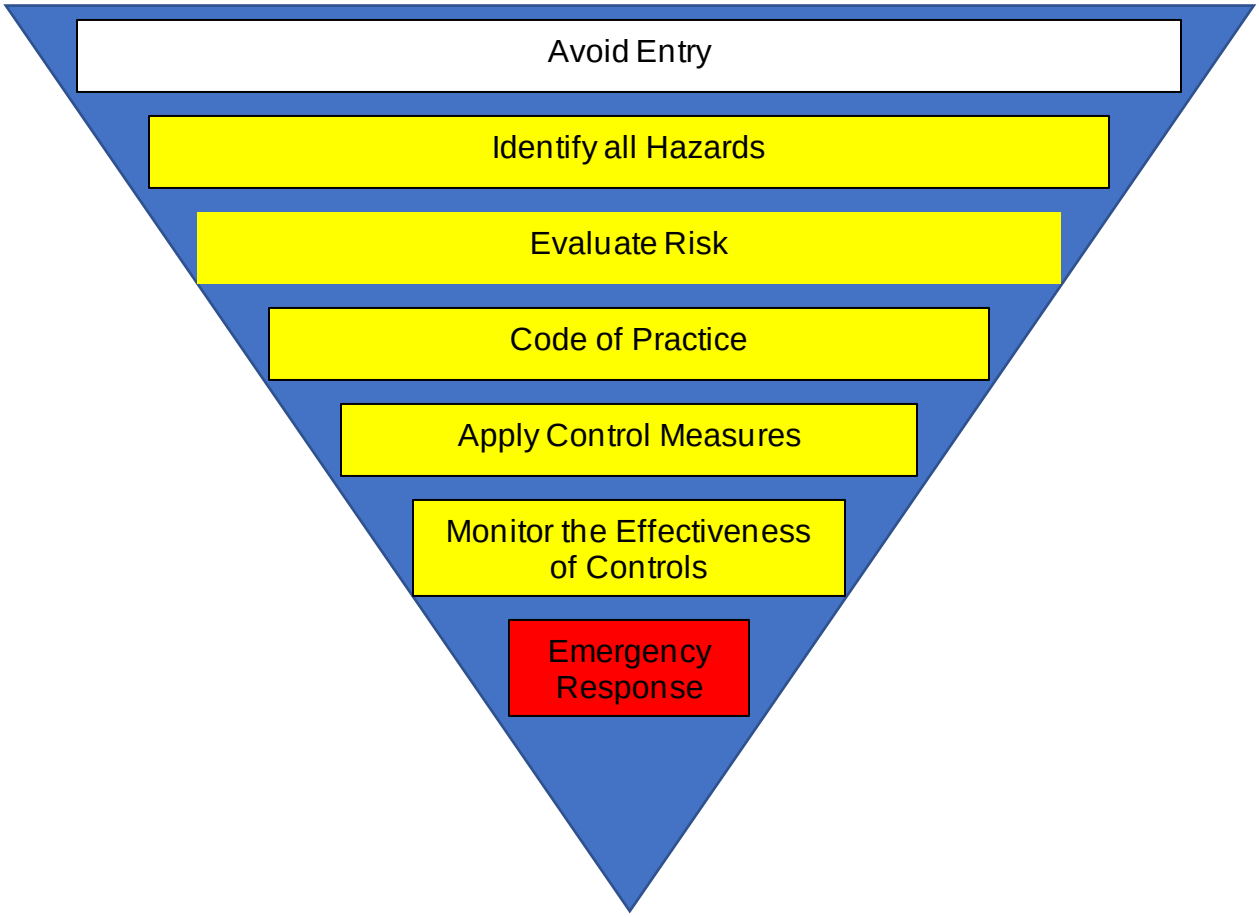
- A ground fault circuit interrupter is a type of circuit breaker that detects any difference (greater than 5 milliamps) between the current being supplied to a tool and the current that returns from the tool.

- If this difference is detected, the circuit breaker shuts off the flow of electricity. If the difference between the flow of electricity to and from the tool was because it was passing through a person, the person would be protected from any further current flowing through them by the ground fault circuit interrupter.

- Do not disconnect the tool from the GFCI because it keeps on tripping (sometimes called “nuisance trips”) the GFCI is operating properly. The reason for the GFCI “tripping” can usually be traced to electrical devices in need of repair, including the extension cords, or the tool or cord is being used in a wet or damp location.

- Electrical tools and equipment used in a confined space where flammable or explosive gases, vapours, or liquids are present must be CSA-approved for hazardous locations.

Hierarchy of Confined Space Entry Procedures



Chapter 4: Summary

What was covered in Chapter 4?

- The hierarchy of controls and how it is applied.

- Controls used for hazards in confined spaces.

Chapter 5: Safety and Protection

Goal:

The student should understand the safety procedures and equipment required for working in confined spaces.

Objectives:

1. The student should understand the confined space entry permit system.
2. The student should be familiar the different PPE required for working in confined spaces.
3. The student should understand the circumstances under which respirators are to be used.
4. The student should understand the differences between the two common types of breathing apparatus.
5. The student should understand the role and responsibilities of the tending worker.

Chapter 5 – Slide 2 – Video - Case Study 1: Oxygen Deficiency in Barge Tank

Safe Entry Permit

- A confined space entry permit is an element of the Code of Practice for Confined Space.
- The Entry Permit is a document that sets out the work to be done and the precautions to be taken in the identified confined space.
- In some ways it functions as a safety checklist to make sure that nothing is overlooked.
- The purpose of an entry permit is to formalize entry into a confined space.
- A permit also informs workers of the hazards and entry procedures and keeps a record of workers who have entered.
- The permit must be posted at the entrance to the confined space, verifying that a review of the requirements has been conducted.
- Depending on the sophistication of the confined space entry program, information on specific work procedures may be stored in a database designed to automatically insert the information into an entry permit for the specific confined space.
- At a minimum the entry permit should be required when:
    - There is a high-hazard atmosphere.
    - Lockout or isolation procedures are required.
    - There is a hazard of entrapment or engulfment.
    - All hazardous confined spaces.

- The entry permit should address the following:
    - The identification of all hazards.
    - List the name of each worker who enters the confined space and the reason for their entry.
    - Provide the location of the confined space.
    - Specify the time period for which the entry permit is valid.
    - The work being done in the confined space, and therefore the safety precautions that must be taken, including isolation and safe work procedures.
    - Any code of practice requirements for entering, being in and leaving the confined space.

- The completed permit should be kept readily available.
- In some situations, and circumstances, better practice is to have the permit posted at each entry point into the confined space.
- An entry permit will cover a specific task or project, which may occur over several shifts.
- The time for which the entry permit is valid is based on the estimated time to complete the project's work activities and must be identified on the permit.
- Some employers use the permit as a means of displaying and/or recording additional information, such as:
    - Air monitoring results, including the tester's initials.
    - Lockout procedures.
    - The ventilation equipment and the air flow required.
    - The required air-testing equipment and contaminants that must be monitored.

- An entry permit should be treated as expired sooner than the stated expiry time if one of the following occurs:
    - The confined space is returned to service.
    - Continuity of responsible supervision for the confined space is broken.
    - The task or project is interrupted for a significant time because of an incident that affects the confined space, (e.g. an emergency or breakdown of equipment).
- Once an entry permit has expired, a new permit must be issued before entry into the confined space is allowed.
- If an employer performs a hazard assessment of a representative sample of identical confined spaces, then a single-entry permit can be used for these and any additional identical confined spaces.

Ineffective Work Permits

- Various drawbacks exist which can lead to an ineffective permit system, some examples are:
    - The format of the permit does not conform to the task to be completed.
    - The workers responsible for signing the permit has not inspected the job to ensure that the isolation, lockout or testing has been completed.
    - The workers are not following or understand the requirements of the permit.
    - The employer is not enforcing or monitoring the permit system.
    - Permits are prepared too far in advance, after the work has commenced, or by workers not trained in Confined Space Entry requirements.

Personal Protective Equipment

- The competent person who prepares the hazard assessment and written work procedures will specify the personal protective equipment (“PPE”) needed for each confined space (or group of similar spaces) and for the work activities that occur there.

- There may be different PPE requirements for workers inside the confined space, rescue workers, and tending workers.

- General requirements for personal protective equipment include the following:

    - All equipment must be used and maintained in accordance with the manufacturers’ instructions.

    - Equipment must be inspected regularly and kept in good working order.

    - Workers must be instructed and trained in the use, limitations, and assigned maintenance duties of personal protection equipment so that they can use the equipment correctly.

    - If the hazard assessment indicates that PPE is required, the employer must ensure that workers wear and use the required PPE properly.

- Employers to provide PPE in a limited number of situations where, for example, there is a breathing hazard or where noise exposure limits are exceeded.

    - This section does not require employers to provide PPE such as hard hats, safety boots, flame resistant clothing or eye protection.

    - Where such equipment is necessary the employer must make sure that workers use it.

- An employer must ensure that all equipment to safely perform confined space work, including personal protective equipment and rescue equipment, is available and inspected to ensure it is in good working order.

- All workers must follow the code of practice for confined space and use the equipment as necessary to protect their health and ensure their safety.

- If workers inside a confined space could become trapped or if a harmful atmosphere could prevent them from escaping without help it is recommended that the worker wear a full-body harness attached to a lifeline that is tended by a safety watch.

- Lifelines can present a danger if they get tangled around equipment or wrapped around a protrusion in a confined space.

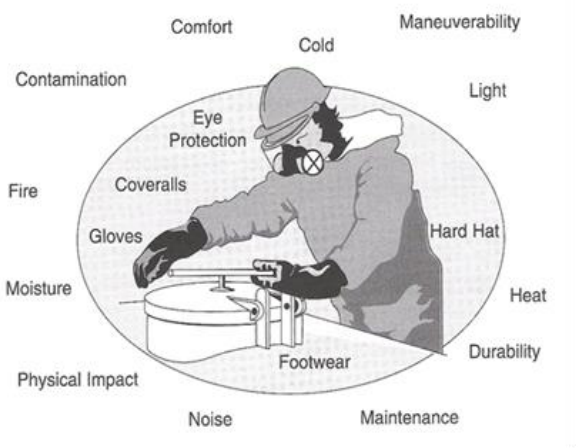
- Lifelines, if they are required, may only be used in a manner that does not endanger a worker by creating another hazard.

- Workers within a confined space must be able to effectively communicate amongst themselves and communicate with workers outside the confined space using a system that is appropriate to the hazards within the confined space, (e.g. communication equipment that functions in the presence of hazardous gases).

- Protective equipment should offer the appropriate protection for the job at hand while being comfortable.

- Routine PPE:

    - Safety Boots.
    - Gloves.
    - Eye Protection.
    - Hard Hat.
    - Hearing Protection.
    - Fire Retardant Coveralls.



- Other considerations for wearing the appropriate equipment for the job include:

    - Extremes of heat or cold temperatures.
    - Potential chemical contact.
    - Potential ignition from welding, etc.
    - Extremes of dryness or wetness.

Working in Dangerous Atmospheres

- "Immediately Dangerous to Life or Health" (IDLH) means a condition in which a hazardous atmosphere exists to such an extent that a worker who is not using an approved respiratory protective device will suffer escape-impairing or irreversible health effects.

- If a worker is required or permitted to enter an atmosphere that is immediately dangerous to life or health, an employer shall ensure that the worker is provided with and uses an approved atmosphere-supplying respirator that is an open circuit Self Contained Breathing Apparatus (SCBA).

- SCBA must operate in a pressure demand or other positive pressure mode.

- SCBA must have a minimum rated capacity of 30 minutes.

- SCBA must be sufficiently charged to enable the worker to perform the work safely, and equipped with a low pressure warning device or an escape respirator.

- Or, if the worker is using Supplied air breathing Apparatus (SABA) it must operate in a pressure demand or other positive pressure mode.

- SABA must have an auxiliary supply of air sufficient to allow the worker to escape in case of failure of the primary air supply equipment.

- An employer shall ensure that compressed air in an atmosphere-supplying respirator used by a worker in an atmosphere that is IDLH meets approved purity requirements.

- Any respiratory protective device for emergency use must be thoroughly inspected by a competent individual not less than once every month and after each use.

Respiratory Protection

- If clean breathable air in a confined space cannot be assured before workers enter, or if it cannot be maintained while workers are inside, the employer must provide the appropriate respirators for workers to safely enter and remain in the space.

- Respirators are to be used only if it is impracticable to provide clean breathable air or if the confined space has an inert atmosphere.

- In these situations, workers rely on respirators either to remove contaminants from the air they inhale or to provide a safe source of air.

- If a respirator is required, the written work procedures must specify the type needed.

- All workers entering the space must wear the appropriate respirator.

- A respirator with a filter removes particles from the air.

- Different classes of filters are available for different types of dusts and fibres.

Half Mask

- A respirator with a cartridge will remove gases and vapours to “clean” the air.

- There are different cartridges for different contaminants.

- The worker must have the right cartridge for the contaminant.

- Not all gases can be “cleaned” by a cartridge respirator.

Full Face Mask

Breathing Apparatus

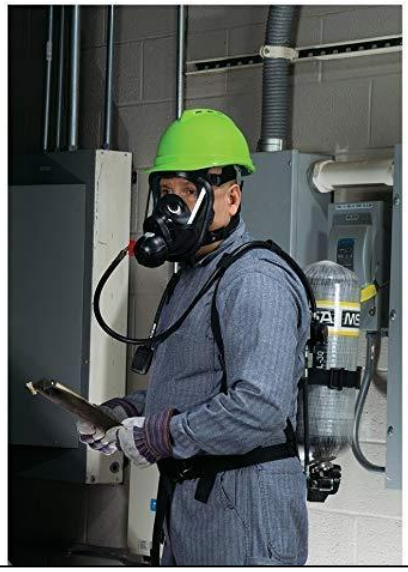
An air-supplied respirator provides clean breathable air.

These must be used when the atmosphere is oxygen-deficient or when filters or cartridges are not able to remove the contaminant to a safe level.

There are two common types of breathing apparatus; Supplied Air Breathing Apparatus (SABA), and Self-Contained Breathing Apparatus (SCBA)

Supplied Air Breathing Apparatus

SABA



Self Contained Breathing Apparatus

SCBA

Fit Test and Medical Evaluation

- If a worker required to use a self-contained breathing apparatus (SCBA) cannot get a good facial seal the worker must not use the apparatus (workers must report this situation to the employer so that it can be corrected).

- The CSA Standard requires that workers who use respirators be free from any physiological or psychological condition that may prevent them from using a respirator (the worker must not have a medical condition that, when combined with respirator use, could endanger his or her health and safety at the worksite).

- A formal fit test is required for all respirators.

- Evaluation of a worker's medical fitness to wear a respirator must be done before the worker is fit tested.

- The evaluation should be appropriate to the level of respirator use and take into consideration:
    - The type of respirator being used.
    - The type and concentration of contaminant the worker will be exposed to.
    - The amount of time that the respirator must be worn.
    - The activities the worker must do while wearing a respirator.

Communications

- With proper communication, work in a confined space is made easier, safer and in many cases, more productive.
- Care must be taken when selecting communication equipment for this unique work environment.
- Confined spaces are very different from any other work area and must be treated accordingly.
- Radio signals do not penetrate metal or concrete reinforced with re-bar, which describes a majority of confined space environments, creating dead spots or reducing signal strength.
- Messages can become garbled or are not received, this prevents continuous communication in certain types of spaces.
- Radio equipment is extremely effective when used by safety attendants outside spaces to maintain contact with their base or, in the event of a problem, to call for rescue assistance.
- The preferred choice for reliable communication in confined spaces is a hardline full duplex system (both parties can hear each other simultaneously), which allows hands-free communication between a tending worker and workers inside the space.
- No matter which method of communication is chosen, the equipment selected should be suited to the particular work environment.
- It should be extremely rugged, resistant to chemicals, environmentally sealed and intrinsically safe if used in a potentially hazardous location.

Tending Worker

- A tending worker – a competent worker trained in the evacuation procedures in the emergency response plan and who is present outside the confined space, at or near the entrance.

- If a safe atmosphere is not possible an employer shall ensure that a worker in a hazardous confined space is attended by and in communication with another worker who has been adequately trained in the rescue procedures is stationed and remains at the entrance to the confined space unless replaced by another adequately trained worker, and is equipped with a suitable alarm to summon assistance.
    - For example, a tending worker would be required under the following conditions:
        - The oxygen content of the atmosphere inside the confined space is less than 19.5 percent by volume.
        - The oxygen content of the atmosphere inside the confined space is greater than 23.0 percent by volume.
        - The concentration of a substance listed in Schedule O inside the confined space is greater than 50 percent of its occupational exposure limit.
        - A hazard other than one listed above is identified by the hazard assessment and the hazard cannot be eliminated or effectively controlled.
- If the conditions, listed above, do not apply to a particular confined space, then a tending worker as described above, having the duties described above, may not be required.
    - Instead a competent worker designated by the employer must be in communication with the worker in the confined space.
    - In some cases, this designated worker may be in a nearby vehicle, or may be at a central dispatch location.

- For every confined space entry, a worker must be assigned as a tending worker, who monitors the well-being of workers inside the space by visually observing them or using another method of checking.
- The tending worker also summons help in the event of an emergency.
- Workers inside the space must be able to contact the tending worker at any time, either through voice or visual contact.
- The tending worker must be stationed outside the confined space, never inside.
- A tending worker must:
    - Keep track at all times of the number of workers inside the confined space.
    - Be in constant communication with the workers inside the confined space.
    - Have a suitable system for summoning assistance.
    - Not leave the area until all workers have left the confined space, or another tending worker is in place.
    - Thoroughly understand the Safe Entry Permit and all related requirements.
    - Stay alert at all times.
    - Remain at the designated entrance.
    - Check with the workers at regular intervals.
    - Watch for potential hazards both inside and outside the confined space and alert worker inside as needed.
    - Be able to sound an evacuation alarm.

    - Have a suitable system for summoning assistance in the event of an incident or emergency.

- The Tending Worker must be knowledgeable in:
    - The Emergency Response Plan.
    - The Communications Procedures.
    - The Safe Operating Procedures.
    - The Scope of Work for the job at hand.
    - The number of workers in the space, and their locations.

- If a Rescue is necessary, the Tending Worker must:
    - Initiate the Emergency Response Plan.
    - Stay outside the confined space until the backup arrives.
    - Give assistance to emergency responders and victims as required.

Confined Space Entry Log Entry Log

- The Tending Worker must keep track of all workers that move in and out of the confined space.
- This document identifies and records the workers names and contact information as well as the ongoing atmospheric tests.

Chapter 5: Summary

What was covered in chapter 5?

- The confined space entry permit system.
- PPE required for working in confined spaces.
- The circumstances under which respirators are to be used.
- The differences between the two common types of breathing apparatus.
- The role and responsibilities of the tending worker.

Chapter 6: Emergency Response

Goal:

The student should understand the requirement for emergency response and the basic elements of an emergency response plan for confined space.

Objectives:

1. The student should be familiar with the requirement for an emergency response as it pertains to a confined space.

2. The student should be familiar with the various roles and responsibilities within an emergency response.

3. The student should be familiar with the elements of the initial response to a confined space emergency.

Employer Responsibilities

- Employers are responsible to develop emergency rescue plans prior to workers entering a confined space.

- Worker safety is always paramount; therefore, workers must not enter or operate inside a confined space if proper safety procedures are not in place.

- Before work in a confined space is allowed, the employer must have an effective emergency response plan in place.

- Employers must ensure that first aid and emergency response and rescue workers receive proper training as part of an overall workplace emergency plan.

- Emergency training for workers must include:
  - first-aid and cardiovascular resuscitation.
  - knowledge of emergency plans and procedures.
  - knowledge of how to use confined space rescue equipment.
- The employer must ensure that rescue personnel are monitoring any signaling system that will be used to summon them in an emergency.

- The employer must ensure rescue procedures include every possible means of eliminating, controlling, or reducing the risk to emergency personnel, including the use of mechanical ventilation.

- If there is the potential for emergency response personnel to enter the confined space, the employer confined space code of practice and the entry permit must include information about emergency PPE requirements and necessary rescue actions.

- All employers are responsible for the provision of first aid equipment, supplies, facilities, and services, as determined by an assessment that would meet the requirements of the OH&S Regulations.

Employee Responsibilities

- A worker must not enter or stay in a confined space unless an effective rescue can be carried out.

- In the event of an emergency, workers must be able to carry out an effective rescue and workers must be able to immediately evacuate a confined space if conditions warrant.

Use of 911 for Confined Space Rescue

- Employer emergency rescue plans cannot rely on fire or ambulance services as the primary response method for confined space emergencies.

- In the case of rescues involving workers in confined spaces and workers suspended in the air after a fall, calling 911 alone and awaiting the arrival of rescue services personnel is considered to be an insufficient emergency response.

- The employer must have some basic level of on-site rescue capability in the event that rescue services personnel are delayed or unable to attend the scene.

- In some situations, rescue services personnel may not have the equipment or skills to perform a rescue.

    - A worker in a confined space deep below ground level in a horizontal tunneling operation.

    - A worker who has fallen in a silo who is suspended in the air that can not be reached from below.

- In such cases, the employer's on-site rescue capability must be such that the work site is virtually self-sufficient in returning a rescued worker to the surface or ground level.

- In an emergency actions taken must be purposeful and well thought out.

- A well-documented plan must be developed, shared with anyone who it may impact (management, workers, responders, etc.).

- You must gain control of the incident at the earliest possible moment to prevent chaos and further injuries.

The Trained Rescue Team

- The person who directs the rescue or evacuation must be adequately trained in such procedures and should be in voice communication at all times with the workers who are performing the rescue.

- A rescue team and rescue procedures should not be used as a substitute for making a confined space safe to enter.

- It is essential that the air is safe to breathe before entry so that a rescue team is not required, except for serious injuries or medical emergencies.

- Over 60% of confined space deaths occur among would-be rescuers.

- Rescue plans and proper training for rescuers must be in place before any confined space entry.

- Workers should be trained not to attempt a rescue or be fully trained and equipped to perform the rescue safely.

- If the rescue persons are employees of another firm or an agency, there should be a written agreement detailing the services to be provided.

- A rescue plan includes practicing the plan , this helps to ensure that personnel, equipment, and procedures are in place to affect rescue.

- The written rescue plan provides a step-by-step means of ensuring all possibilities are considered.

- Practicing the plan provides information about where improvements must be made.

- The rescue plan should be practiced frequently enough to maintain the competency of the rescuers, but no less than once each year.

- Every person assigned rescue duties must be properly equipped and adequately trained to carry out these duties.

- The supervisor of the entry, or the tending worker, must notify rescue personnel of work to be done before a worker enters a confined space.

- If more than one confined space is to be entered at the same time, rescue personnel need to know this and be on alert status.

Confined Space Rescue Procedures

- Emergency rescue plans and procedures are specific to individual confined spaces, depending on the hazards noted during the confined space hazard assessment.

- Emergency rescue plans must indicate whether rescue teams are available at the confined space entry or at another location.

- Regardless of their location, emergency response teams must be within a reasonable distance to quickly respond to any emergency.

- Written procedures for rescue must be in place before every confined space entry and consider the following:

    - Additional workers located outside to assist.
    - Rescue from the outside (if possible).
    - Requirements for use of a safety harness and lifeline.
    - If IDLH conditions exist or could develop, rescuers must enter only with an SCBA or supplied-air respirator equipped with an escape bottle.
    - Small-diameter openings will require special consideration for rescue workers who are encumbered with SCBA.
    - A key objective is to correct atmospheric hazards prior to entry and supply adequate ventilation to ensure a safe atmospheric environment whenever practicable.
    - All hazards of the space as specified in the hazard assessment.
    - Possible hazards that may arise during rescue, the appropriate evaluation of these hazards, and control methods recommended by a qualified person.
    - Dimensions of the space, location of entry and exit points, and obstacles to removing an injured worker.
    - Rescue equipment required for each space.
    - Personal protective equipment for rescuers, including appropriate respirators for any contaminants or IDLH conditions.
    - Communication between workers, rescuers, the supervisor of the entry, and tending worker.
    - Rescue methods for a worker who is unconscious, unresponsive (on or off of a lifeline), or distressed.

Initial Response to a confined space emergency:

1. Warn others, ensure the safety of all workers.

2. Call for help, initiate the site emergency response plan (ERP) and Rescue Plan.

3. Assess the situation and resources available to respond.
- Maintain the safety of the emergency site where the incident has occurred by identifying and controlling any critical hazards.
- Have a worker meet emergency responders and show them a safe way in to access the emergency site.
- When safe to do so assign a competent co-worker to maintain contact with the casualty to provide reassurance and remind the casualty what to do while waiting to be rescued.
- Do not allow co-workers who are not properly equipped or trained to perform the rescue.
- Do not experiment with equipment or procedures that have not been thoroughly thought out and with which training and drills have been carried out.

4. When safe to do so, proceed with the rescue, or wait for emergency services to arrive.
- Workers involved in rescue must be competent and properly equipped.
- Once the rescue is complete, take the casualty to a safe location.

5. Persons qualified in first-aid should provide first-aid until arrival of emergency medical personnel.

6. Ensure all appropriate authorities have been notified as per the ERP.
- Document, document, document
- Cooperate fully with police, and/or OH&S Investigators.

Follow-Up

- Ensure co-workers are debriefed and receive any assistance they may require. Police services may be able to offer assistance through victim services.

- Before allowing work to begin after an incident, replenish all first-aid and rescue supplies and equipment.

- When appropriate, review the incident and ensuing response, and make any revisions to the ERP or Rescue Plan that may be necessary.

Chapter 6, Slide 22 View the “Precious Time” Video

Answer the following questions?

- Was this a confined space?
- Was it a hazardous confined space?
- What measures should have been taken to prevent the incident?
- If they had a Code of Practice and followed the requirements would it have prevented the incident?

Chapter 6: Summary

What was covered in chapter 6?

- The requirement for an emergency response as it pertains to a confined space.
- The various roles and responsibilities within an emergency response.
- The elements of the initial response to a confined space emergency:

Characteristics of Common Gases

Material	Flashpoint	Combustible Range	Physical Description	MAIN Danger	8 hr. TWA	IDLH	Density (Air =1)
Carbon Dioxide (CO_2)	N/A	Non-Combustible	Colourless, Odourless	Displaces oxygen. Toxic	5,000 ppm	50,000 ppm	1.5
Carbon Monoxide (CO)	-191 ˚C	12.5 – 75%	Colourless Odourless	Toxic— asphyxiant	25 ppm	1,500 ppm	0.97
Chlorine (Cl_2)	N/A	Non-Combustible	Greenish yellow colour; sharp pungent odour	Toxic— lung and eye irritant.	0.5 ppm	10 ppm	2.5
Diesel Fuel	37.8 ˚C	1 – 6%	Clear to yellow liquid	Flammable	15 ppm	600 ppm	.9
Unleaded Gasoline	-65 ˚C	1 – 7.6%	Colourless; sweet odour	Fire and explosion. Toxic – nervous system depressant	300 ppm	1100 ppm	3.5
Hydrogen Sulphide (H_2S)	-82 ˚C	4 – 46%	Colourless; Sulfurous odour	Flammable Poisonous Caustic	10 ppm	100 ppm	1.2
Methane (CH_4)	-188 ˚C	5 – 15%	Colourless Odourless	Fire and explosion	O_2 at 19.5%	20% of LEL	0.6
Nitrogen (N_2)	N/A	Non-Combustible	Colourless Odourless	Displaces oxygen	O_2 at 19.5%	Displaces oxygen	0.97
Propane	-40 ˚C	2.2 – 9.5%	Colourless Cabbage odour	Flammable	1,000 ppm	20% of LEL	1.5
Sulfur Dioxide (SO_2)	N/A	N/A	Colourless Sulfurous, suffocating odour	Toxic – severe lung irritant	2 ppm	100 ppm	2.2
Oxygen (O_2)	N/A	Enhances combustion.	Colourless Odourless	L - asphyxiant H – enhances combustion	N/A	<19.5% >22%	1.2

Confined Space Entry Log (Example)

CONFINED SPACE ENTRY LOG								
DATE:					LOCATION:			
WORKER NAMES (Please Print and Initial)								
1.					6.			
2.					7.			
3.					8.			
4.					9.			
5.					10.			
Tending Worker:								
Crew Leader:								
	# of Workers		Time (am/pm)		**OXYGEN 21% Is ideal**	**FLAMMABLE LEL & UEL**	**TOXICITY % OR PPM**	**Temp. C or F**
	IN	**OUT**	**IN**	**OUT**				
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10								