Introduction to Confined Spaces

• Welcome
• By taking ClickSafety’s Confined Spaces online safety course, you will have a better understanding of safety regulations according to OSHA’s standards. Upon successful completion of this course, you will be able to:
  • Recognize requirements of the OSHA Confined Spaces in Construction Standard, 29 CFR 1926, Subpart AA (effective August 3, 2015)
  • Identify hazards typical to confined spaces, how they are recognized and evaluated, and ways these hazards are controlled
  • Recognize components of the confined space permit process
  • Identify duties of individual confined space team members
  • Recognize the dangers of entry rescues and the preparations required for making a rescue
  • Recognize basic employer requirements for protecting workers from exposure to confined space entry hazards
  • This session should last approximately 75 minutes.
Introduction to Confined Spaces

- Fatal Fact No. 36
- A contract employee was assigned to sandblast the inside of a reactor vessel during turnaround activities at a petrochemical refinery. Instead of relying on the contract company's own air compressors in accordance with the contractor's policy, the contract foreman connected the employee's supplied air respirator to a hose containing what he thought was plant air. Instead it was nitrogen. Both hoses were identical except for markings at the shutoff valve. The sandblaster entered the vessel, descended to the bottom, placed the respirator hood on his head and was overcome. Click on the tab to view the detailed accident investigation and study it before moving to the next screen.
Introduction to Confined Spaces

• The threat to safety
  – Hundreds of preventable deaths/injuries occur each year
  – Specific hazards include
    • lack of oxygen,
    • fire and explosions,
    • toxic atmospheres,
    • being trapped or buried,
    • being caught or struck by equipment,
    • electrocution, and
    • other serious hazards.
Introduction to Confined Spaces

- Deception
- Confined spaces are dangerous because
  - they can appear deceptively harmless,
  - gases & vapors may not be seen or smelled, and
  - it takes only once for something to go wrong.

Safety Tip: Many fatalities that occur in confined spaces are would-be rescuers. Fatalities can occur when rescuers:
- Are overcome by their emotions
- Take unnecessary chances
- Do not know hazards involved
- Do not have a plan of action
- Lack confined space rescue training
Introduction to Confined Spaces

• Case #1
• Welder enters steel pipe (24-inch diameter) and is tasked to grind bad weld 30 feet from entry.
• Crew members add oxygen near bad weld.
• After 5 minutes of intermittent grinding, fire breaks out and envelopes welder’s clothing.
• Crew member pulls welder out & extinguishes fire.
• Welder dies from burns the next day.
Introduction to Confined Spaces

• Case #2
• Employees were laying sewer pipe in 15 foot deep trench, which was
  – 4 feet wide at bottom; 15 feet wide at top,
  – not shored or protected to prevent cave-in, and
  – made up of a lower portion of sand & gravel; upper portion clay & loam.
• Employees had to exit by climbing over backfill, resulting in
  – a small cave-in covering employee to his ankles and
  – a second cave-in when co-worker went to help.
• First employee died of ruptured heart.
• Second employee suffered hip injury.
Introduction to Confined Spaces

• Case #3
• City wastewater treatment plant supervisor entered manhole and collapsed from oxygen-deficient atmosphere.
• Victim’s two supervisors entered in rescue attempt, with
  – one collapsing while the other managed to escape.
• Both victims were pronounced dead at local hospital.
• Tests: 12.8% oxygen; no hydrogen sulfide; no flammable atmosphere
• Cause of death: asphyxiation

Safety Tip: OSHA is an agency of the United States Department of Labor. It was created by Congress of the United States under the Occupational Safety and Health Act, signed by President Richard M. Nixon, on December 29, 1970. Its mission is to prevent work-related injuries, illnesses, and occupational fatality by issuing and enforcing standards for workplace safety and health. OSHA defines Oxygen Deficiency as: A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.
Confined Spaces in Construction Standard

- OSHA’s Confined Spaces in Construction Standard
- Confined spaces, such as sewers, manholes, crawl spaces and tanks, are not intended for continuous worker occupancy. They can be very difficult to enter, more difficult to exit and they can be deadly.
- OSHA’s new regulation found in Title 29 of the Code of Federal Regulations, Subpart AA, Confined Spaces in Construction is a rule designed to afford construction workers the same level of protections as workers in other industries who work in confined spaces.

TIP: For those employees, supervisors and managers that will be engaged in duties as attendants, entrants, supervisors, competent persons, more comprehensive training is needed.
OSHA’s Confined Spaces in Construction Standard

OSHA has estimated that this rule will prevent over 800 serious injuries & save the lives of 5 construction workers every year. To illustrate this fact, Assistant Secretary of Labor for Occupational Safety and Health Dr. David Michaels recently shared that if this new rule had been in place and followed, it could have saved the lives of 2 workers killed in Georgetown, Idaho just last year.
Confined Spaces in Construction Standard

- OSHA’s Confined Spaces in Construction Standard
- Case Study
- Bo Taylor was applying an aerosol sealant in a manhole, when he was overcome by fumes and fell into 3 feet of water at the bottom of the manhole. Trent Sorenson, Bo's uncle and the site superintendent, went into the manhole to rescue his nephew but was also overcome by the toxic contaminants.
- Trent's son, Tyler, left to call for help. A volunteer arrived and attempted rescue using his own self-contained breathing apparatus, but the mask leaked and the volunteer had to stop the rescue attempt. EMTs arrived approximately 45 minutes after Bo lost consciousness. Neither of the two men survived.
- With proper planning, ventilation, rescue training, proper equipment and prior engagement with local emergency services, Bo Taylor and Trent Sorenson could be alive today.

**TIP:** The final OSHA rule, effective August 3, 2015 can’t go back and save the lives of Bo and Trent, but we know that if appropriate confined spaces entry procedures are followed, going forward, workers' lives can be saved and serious injuries prevented.
Confined Spaces in Construction Standard

• OSHA’s Confined Spaces in Construction Standard
• There are some differences between the Confined Spaces in the General Industry standard and OSHA’s Confined Spaces in Construction standard.
• Unlike most general industry worksites, construction sites are dynamic, continually evolving, commonly fast paced with the number and characteristics of confined spaces changing as work progresses.
• The Confined Spaces in Construction standard emphasizes training, continuous worksite evaluation and communication requirements to further protect workers' safety and health.
Confined Spaces in Construction Standard

- OSHA’s Confined Spaces in Construction Standard
- Competent person. A "competent person" must conduct the initial construction jobsite evaluation. The OSHA confined spaces standard that applies to the manufacturing & GI standard does not specify who has to conduct the evaluation. The competent person approach is common in construction industry rules.
- Information exchange. Information exchange requirements between the host employer, controlling contractor, entry employers and others to include what discussions must be conducted, and when, during confined space entry.
- Hazard monitoring. Air contaminant and engulfment hazard monitoring must be done continuously, as the technology is readily available for most hazards. For substances where continuous monitoring technology is not available, periodic monitoring is required.
- Emergency services. The construction rule explicitly requires employers to coordinate emergency services before workers enter the confined space.
- Controlled atmosphere. During "controlled atmosphere" entry, employers may isolate physical hazards rather than eliminate all of them using such methods as using lock-out/tag-out or similar. This is consistent with interpretations issued for the GI rule, but contains additional clarifications in the final rule for construction.
Confined Spaces in Construction Standard

• Subpart AA—Confined Spaces in Construction
• 1926.1200 Reserved
• 1926.1201 Scope
• 1926.1202 Definitions
• 1926.1203 General requirements
• 1926.1204 Permit-required confined space program
• 1926.1205 Permitting process
• 1926.1206 Entry permit
• 1926.1207 Training
• 1926.1208 Duties of authorized entrants
• 1926.1209 Duties of attendants
• 1926.1210 Duties of entry supervisors
• 1926.1211 Rescue and emergency services
• 1926.1212 Employee participation
• 1926.1213 Provision of documents to Secretary
Confined Spaces in Construction Standard

- **Scope**
- This standard sets forth requirements for practices and procedures to protect employees engaged in construction activities at a worksite with one or more confined spaces, subject to limited exceptions.
- Examples of locations where confined spaces may occur include, but are not limited to, the following: Bins; boilers; pits (such as elevator, escalator, pump, valve or other equipment); manholes (such as sewer, storm drain, electrical, communication, or other utility); tanks (such as fuel, chemical, water, or other liquid, solid or gas); incinerators; scrubbers; concrete pier columns; sewers; transformer vaults; heating, ventilation, and air-conditioning (HVAC) ducts; storm drains; water mains; precast concrete and other pre-formed manhole units; drilled shafts; enclosed beams; vessels; digesters; lift stations; cesspools; silos; air receivers; sludge gates; air preheaters; step up transformers; turbines; chillers; bag houses; and/or mixers/reactors.
Confined Spaces in Construction Standard

- Exceptions
- This standard does not apply to:
  - Construction work regulated by §1926 subpart P—Excavations.
  - Construction work regulated by §1926 subpart S—Underground Construction, Caissons, Cofferdams and Compressed Air.
  - Construction work regulated by §1926 subpart Y—Diving.

Special Note
Although excavations are exempt from Subpart AA, we will refer to excavation confined space hazards as examples in this course because they are so prevalent in construction. Just remember that they are governed by subpart P of the OSHA construction standards.
Review #1

- Review #1
- Confined space work must comply with:
  - OSHA 29 CFR 1926 Subpart AA 10.146 titled “Confined Spaces in Construction”
- Each year, approximately 400 die in confined space accidents from:
  - Oxygen deficiency, fire and explosion hazards, toxic atmospheres, entrapment and engulfment hazards, as well as hazards from being crushed, struck, or caught in machinery or equipment.
  - Unfortunately for these victims, the deaths and injuries were preventable had proper CSE procedures been followed.
- OSHA has estimated that this rule will prevent over 800 serious injuries & save the lives of 5 construction workers every year.
- The Confined Spaces in Construction standard emphasizes training, continuous worksite evaluation and communication requirements to further protect workers' safety and health.
- The standard sets forth requirements for practices and procedures to protect employees engaged in construction activities at a worksite with one or more confined spaces, subject to limited exceptions.
Definitions

• What is a Confined Space?
  – A confined space has three important elements
    • it is large enough, and configured for, a person to enter and perform work,
    • it has a restricted means for entry or exit, and
    • it is not designed for continuous human occupancy.
  – Examples: tanks, silos, boilers, sewers, pipelines, ship’s holds, trenches, etc.

**TIP:** Generally speaking, a pit, shaft, or tank that is even entirely open on one plane (e.g. top) can be considered a confined space if the means for entering the space (stairway, ladder, etc.) are narrow, twisted, or otherwise configured in such a way that would hinder an entrant’s ability to quickly escape. Similarly, the pit, shaft, or tank itself may be confining because of the presence of pipes, ducts, baffles, equipment, or other factors that would hinder an entrant’s ability to escape.
Definitions

• Confined Space

• Confined spaces can be
  – below & above ground;
  – in nearly all industries & workplaces; and
  – in both small & large
    • underground vaults,
    • truck or rail tank cars,
    • aircraft wings,
    • storage bins, pits, dikes, and
    • vessels, silos, vats.

Safety Tip: Confined spaces are found not only in industrial settings but also public places such as shopping malls (e.g. water pump vaults). There have been reports of maintenance employees entering these areas and losing consciousness.
Definitions

• What is a Permit-required Confined Space?
  – It will have one or more of four characteristics

• 1. Contains, or has the potential to contain, a hazardous atmosphere.
  – Examples include: storage tanks, reaction vessels, sewers, trenches or excavations with chemical liquids, vapors or gases

• 2. Contains a material that has the potential for engulfing an entrant.
  – Examples: A grain silo, trench, or excavation with sloughing walls

• 3. Has an internal configuration that could potentially trap or asphyxiate an entrant.
  – Example: storage tanks with inward sloping walls

• 4. contains any other serious safety or health hazards.
Definitions

- What is an “Entry permit”? A tool for safety
- Entry permit (permit) means the written or printed document that is provided by the employer who designated the space a permit space to allow and control entry into a permit space and that contains the information specified in §1926.1206 of this standard.
  - A checklist that identifies
    - the hazards associated with the space and
    - the steps taken to reduce these hazards.
  - Authorizes entrance into a confined space
Definitions

• Confined Spaces Entry (CSE) Permit
  – Lists hazards in the confined space
  – Instructs how to control each hazard
  – Establishes conditions for safe entry
  – Establishes rescue procedures

Photo of a confined spaces entry permit
Definitions

• Specific Elements of a CS Entry Permit
  – The permit identifies
    • confined space to be entered,
    • Hazards,
    • Preparation,
    • required equipment for entry and work,
    • authorized entrants, attendants, rescue services, and
    • testing requirements/authorizations.
Definitions

- Entry

Entry means the action by which any part of a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant’s body breaks the plane of an opening into the space, whether or not such action is intentional or any work activities are actually performed in the space.
• Competent Person

• Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.
Definitions

• Qualified Person

• Qualified person means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
Definitions

• Authorized Entrant and Attendant
• Authorized entrant means an employee who is authorized by the entry supervisor to enter a permit space.
• Attendant means an individual stationed outside one or more permit spaces who assesses the status of authorized entrants and who must perform the duties specified in §1926.1209.
Definitions

• Entry Supervisor

• Entry supervisor means the qualified person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this standard.

• Note. An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this standard for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.
A confined space has three important elements:
- it is large enough and configured for a person to enter and perform assigned work,
- it has limited or restricted means for entry or exit, and
- it is not designed for continuous human occupancy.

Examples of confined spaces are tanks, silos, boilers, sewers, pipelines, ship’s holds and other such locations.

What is a permit-required confined space?
- 1. Contains, or has the potential to contain, a hazardous atmosphere (storage tank, excavation, sewer, etc.), or
- 2. Contains a material that has the potential for engulfing an entrant (grain silo, trench, etc.), or
- 3. Has internal configuration, such that an entrant could be trapped or asphyxiated (storage tank with inward sloping walls), or,
- 4. One that contains any other recognized serious safety or health hazard, such as a sump or pit with rotating machinery or stored energy.
• Review #2
• Confined space permit
  – a tool for safety
  – a checklist to identify hazards associated with the space
  – the steps taken to reduce these hazards.
  – authorizes entrance into a confined space
  – lists all hazards in the confined space,
  – instructs how to control each hazard,
  – establishes conditions for safe entry, and
  – establishes rescue procedures.

• Specific Elements of a CS Permit
  – confined space to be entered
  – hazards
  – preparation, required equipment for entry and work
  – authorized entrants, attendants, rescue services, and
  – testing requirements/authorizations

IDLH
Immediately dangerous to life or health: Immediate or delayed threat to life, Irreversible adverse health effects, Interference with ability to escape unaided
General Requirements

• Before Work Begins – The Competent Person
• Before it begins work at a worksite, each employer must ensure that a competent person identifies all confined spaces in which one or more of the employees it directs may work, and identifies each space that is a permit space, through consideration and evaluation of the elements of that space, including testing as necessary.
General Requirements

• Inform
• If the workplace contains one or more permit spaces, the employer must:
  • 1. Inform exposed employees by posting danger signs or by any other equally effective means, of the existence and location of, and the danger posed by, each permit space; and
  • 2. Inform, in a timely manner and in a manner other than posting, its employees’ authorized representatives and the controlling contractor of the existence and location of, and the danger posed by, each permit space.

TIP: A sign reading “DANGER – PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER” or using other similar language would satisfy the requirement for a sign.
General Requirements

- Prevent Entry
- Each employer who identifies, or receives notice of, a permit space and has not authorized employees it directs to work in that space must take effective measures to prevent those employees from entering that permit space, in addition to complying with all other applicable requirements of this standard.
General Requirements

- Written Program
- If any employer decides that employees it directs will enter a permit space, that employer must have a written permit space program that complies with §1926.1204 implemented at the construction site. The written program must be made available prior to and during entry operations for inspection by employees and their authorized representatives.

TIP: An employer may use the alternate procedures specified in paragraph §1926.1203(e)(2) for entering a permit space only under the conditions set forth in paragraph §1926.1203(e)(1).
General Requirements

• Entry into Permit Spaces
• The following requirements apply to entry into permit spaces that meet the conditions set forth in paragraph §1926.1203(e)(1):
  – Any conditions making it unsafe to remove an entrance cover must be eliminated before the cover is removed.
  – When entrance covers are removed, the opening must be immediately guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.
  – Before an employee enters the space, the internal atmosphere must be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any employee who enters the space, or that employee’s authorized representative, must be provided an opportunity to observe the pre-entry testing required by this paragraph.
  – No hazardous atmosphere is permitted within the space whenever any employee is inside the space.
General Requirements

• Additional conditions necessary for entry into permit spaces.
• Forced air ventilation must be used,
• The atmosphere within the space must be monitored
• Procedures to take if a hazard is detected during entry:
  • The employer must ensure a safe method of entering and exiting the space.
• The employer must verify that the space is safe for entry and that the pre-entry measures have been taken, through a written certification.
Confined Spaces Safe Work Practices

• Anticipate/recognize/respond
  – Hazards must be identified on the CSE permit
  – Check for
    • chemical hazards
    • acceptable oxygen levels
    • hazards that may entrap/bury
    • other recognized hazards
      – stored energy
      – noise or temperature hazards
      – animal hazards
Confined Spaces Safe Work Practices

• Hazards evaluation
  – Hazards identified on the CSE permit
  – Test before and during occupancy for
    • oxygen levels
    • air contaminants
    • flammable gases and vapors
    • mechanical and electrical equipment
    • ability to perform safe work practices
    • operability of safety systems
    • other hazards

Safety Tip
The specified order for atmospheric testing is:
Oxygen, Flammable gases and vapors, Other
Confined Spaces Safe Work Practices

• Oxygen test
  – Oxygen is necessary to sustain life.
  – O2 levels should be between 19.5% and 23.5%.
  – Test first for O2
    • If oxygen deficient (<19.5%), use air-supplied equipment
    • If oxygen enriched (>23.5%), ventilate space until safe

**TIP:** Oxygen enriched atmospheres can be extremely dangerous because they can produce flash fires such as the one that struck Apollo I in 1967, killing all three astronauts on the launch pad.
Confined Spaces Safe Work Practices

• Test for flammability and potential for explosion
  – Certain gases and vapors may ignite or explode under the right conditions.
    • Test the flammable limits.
    • Use safe/non-sparking instrument to test the LFL.
    • No entry is permitted if a space contains flammable gas, vapor, or mist in excess of 10% of its LFL.
    • Ventilate space to achieve a safe level before entry.

Safety Tip
Check Safety Data Sheet (SDS) or Material Safety Data Sheet (MSDS) for substances to determine properties and hazards.
Confined Spaces Safe Work Practices

• Air contamination test
  – Check air contaminants (after identifying oxygen level [e.g. CO, H2S]).
  – Check safety data sheets.
  – Test the atmosphere with appropriate equipment.
  – Control exposure to ensure safety.

TIP:
Carbon monoxide (CO) is an odorless, colorless gas and has poor warning properties. Early stages of CO intoxication are nausea and headache. Carbon monoxide is considered dangerous at 200 ppm, because it forms carboxyhemoglobin in the blood which prevents the distribution of oxygen in the body. Hydrogen sulfide (H2S) is a colorless, flammable, highly toxic gas and has a characteristic rotten-egg odor that is detectable at concentrations as low as 0.5 parts per billion (ppb). Inhalation of high concentrations of hydrogen sulfide can produce extremely rapid unconsciousness and death. Caution! Higher concentrations of H2S numb the sense of smell increasing the hazard!
Review #3

- Anticipating and recognizing entry hazards is the first step in a successful CS entry.
- Check for chemical hazards, acceptable oxygen levels, hazards that may entrap/bury, stored energy, noise or temperature hazards, animal hazards.
- Hazard evaluation tests before and during occupancy.
- Oxygen deficiency is less than 19.5% oxygen.
- “Flammable limits” refer to the conditions under which certain gases and vapors may ignite/explode. Lower flammable limit (LFL) is the lowest concentration of a material that will burn in air.
- Check Safety Data Sheet (SDS) or Material Safety Data Sheet (MSDS) for substances to determine properties and hazards.
Confined Spaces Safe Work Practices

• Hazard control systems
  – Identified on the permit
  – Control systems include isolation
    • To control/remove potentially hazardous substances or other hazards from the confined space.
Confined Spaces Safe Work Practices

• LOTO
  – Control systems include:
    • Isolation
  – Lockout and tagout/control of hazardous energy (LOTO/COHE) procedures to isolate hazardous energy such as electrical, pneumatic, hydraulic, or mechanical energy.
  – Do you see anything missing in the photo? Use your mouse to identify.
Confined Spaces Safe Work Practices

• Blanking
  – Control systems include:
    • Isolation
    • Lockout and tagout
  – Blanking, or disconnecting, and capping lines that may empty into the permit space.
Confined Spaces Safe Work Practices

• Bleeding
  – Control systems include:
    • Isolation
    • Lockout and tagout
    • Blanking, or disconnecting, and capping.
  – Bleeding blanked or isolated equipment to prevent contents from emptying into the permit space.
Confined Spaces Safe Work Practices

- Safe atmosphere
  - Control systems include:
    - Isolation
    - Lockout and Tagout
    - Blanking, or disconnecting and capping
    - Bleeding blanked or isolated equipment
  - Ventilate the permit space with fresh air to remove air contaminants and provide a safe atmosphere.
Confined Spaces Safe Work Practices

• Flushing
  – Control systems include
    • Isolation
    • Lockout and Tagout
    • Blanking, or disconnecting and capping
    • Bleeding blanked or isolated equipment
    • Ventilate with fresh air
  – Flush the space with liquid such as water to remove or dilute toxic or corrosive liquids and residues.
Confined Spaces Safe Work Practices

- Purge Explosive Vapors
  - Control Systems include:
    - Isolation
    - Lockout and Tagout
    - Blanking, or disconnecting and capping
    - Bleeding blanked or isolated equipment
    - Ventilate with fresh air
    - Flush with liquid
  - Purge the space with an inert gas such as carbon dioxide or nitrogen to control potentially flammable/explosive vapors and gases.
Confined Spaces Safe Work Practices

• External hazard control
  – External hazards include
    • falling materials/equipment and
    • vehicle or generator exhaust entering space.
  – Control Methods
    • Restrict unauthorized personnel.
    • Use barricades/flags to warn of potential hazard.
    • Post permit.
Review #3.5

- Review #3.5
- Hazard controls:
  - Isolation to control/remove potentially hazardous substances or other hazards from the confined space.
  - Lockout and tagout procedures to control and isolate hazardous energy, such as electrical, pneumatic, hydraulic, or mechanical energy.
  - Blanking, or disconnecting, and capping lines that may empty into the permit space.
  - Bleeding blanked or isolated equipment minimizes contents and prevents them from emptying into the permit space.
  - Ventilate with fresh air.
  - Flush the space with liquid such as water.
  - Purge the space with an inert gas such as carbon dioxide or nitrogen.
  - External: Falling material, vehicle exhaust.
• Entry permit (permit) means the written or printed document that is provided by the employer who designated the space a permit space to allow and control entry into a permit space and that contains the information specified in §1926.1206
• Each entry employer must:
  • (a) Implement the measures necessary to prevent unauthorized entry;
  • (b) Identify and evaluate the hazards of permit spaces before employees enter them;
Permit Required Confined Space Entry Program and Permit Process

• Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:
  – (1) Specifying acceptable entry conditions;
  – (2) The opportunity for affected and identified others to observe any monitoring or testing of permit spaces;
  – (3) Isolating the permit space and physical hazard(s) within the space;
  – (4) Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;
  – (5) Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards;
  – (6) Verifying that conditions in the permit space are acceptable for entry and work; and
  – (7) Eliminating any conditions that could make it unsafe to remove an entrance cover.
Permit Required Confined Space Entry Program and Permit Process

• Permitting Process
• Before entry begins, the entry supervisor identified on the permit must sign the entry permit to authorize entry.
• The completed permit must be made available at the time of entry to all authorized entrants and/or others, (e.g. posting permit)
• Duration of the permit to complete the assigned task or job identified
• Termination of the permit conditions specified.
• Retention of canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program
Permit Required

Confined Space Entry Program and Permit Process

- Entry Permit
- The entry permit must identify:
  - (a) The permit space to be entered;
  - (b) The purpose of the entry;
  - (c) The date and the authorized duration of the entry permit;
  - (d) The authorized entrants, attendants and entry supervisor;
  - (e) Means of detecting an increase in atmospheric hazard levels in the event the ventilation system stops working;
  - (f) Each person, by name, currently serving as an attendant;
  - (g) The individual, by name, currently serving as entry supervisor, and the signature or initials of each entry supervisor who authorizes entry;
  - (h) Hazards of the permit space to be entered;
  - (i) Measures used to isolate the permit space and to eliminate or control hazards before entry;
  - (j) Acceptable entry conditions;
  - (k) Results of tests and monitoring performed and names or initials of the testers;
  - (l) The rescue and emergency services and the means for summoning those services;
  - (m) The communication procedures used by authorized entrants and attendants to maintain contact during the entry;
  - (n) Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this standard;
  - (o) Any other information necessary to ensure employee safety; and
  - (p) Any additional permits (e.g. hot work), that have been issued to authorize work in the permit space.
CSE Equipment

• Permit equipment
  – Air Testing and monitoring
  – Communications
  – Ventilation
  – Personal Protection
  – Lighting
  – Barriers and flagging
  – Removal, such as ladders
  – Emergencies and rescue
  – Isolation
  – Lockout and Tagout
CSE Equipment

• Air monitoring and testing
  – Safe entry depends upon a safe environment.
  – Monitoring equipment must measure the hazards such as
    • oxygen,
    • flammability,
    • air contaminants,
    • radiation, and
    • extreme temperatures.

Safety TIP: Gas-monitoring instruments are designed to protect personnel from unseen hazards that may exist in workplace environments, including confined spaces. It is vital to worker safety that these instruments are maintained and calibrated properly. Click on the following link to learn more: https://www.osha.gov/dts/shib/shib093013.html
CSE Equipment

• Air monitoring equipment
  – Equipment must be intrinsically safe.
  – You must
    • be familiar with operation, interpretation, and calibration;
    • take note of alarms on equipment; and
    • follow manufacturer’s instructions.
CSE Equipment

• Communications equipment
  – Choosing a communications system
    • Factors to be considered include
      – the size and shape of confined space,
      – the number of entrants,
      – the lighting, and
      – other factors.
CSE Equipment

• Communications systems
  – Systems may include
    • voice,
    • hand signals,
    • walkie talkies,
    • radios, and
    • horns and alarms.
  – If flammable vapors or gases are present use intrinsically
    safe equipment.

TIP: An “intrinsically safe” classification and design means
that an electronic circuit and its wiring will not cause
any sparking or arcing and cannot store sufficient energy
to ignite a flammable gas or vapor, and cannot produce
a surface temperature high enough to cause ignition.
Such a design is not explosion proof, nor does it need to be.
For permanent installations, such an installation may include
“intrinsically safe barriers” that are located outside
the hazardous location, and limit the amount of energy
available to the device located in the hazardous area.
CSE Equipment

• PPE
  – Consider engineering and work practice controls first.
  – Conduct PPE hazard assessment.
  – Select PPE based upon known and anticipated hazards.
  – PPE must meet industry standards.
  – Get PPE training.
CSE Equipment

• PPE Definitions
  – PPE is equipment that protects
    • head,
    • face,
    • eyes and ears,
    • respiratory protection,
    • hands and feet,
    • feet, and
    • whole-body protection.
  – Specialized PPE (i.e. fall protection)
CSE Equipment

• Respiratory protection
  – Two principal types
    • Supplied air respirators, used in
      – oxygen-deficient environments,
      – IDLH environments, and
      – atmospheres with high levels of air contaminants.
    • Air-purifying respirators
      – filter out contaminants at generally lower levels,
      – do not supply oxygen, and
      – are color-coded to identify chemical protection.

Safety Tip
The employer shall select only NIOSH-certified respirators. Respirators must be used in compliance with the conditions of its certification.”
CSE Equipment

- Rescue equipment
  - Varies with entry type, hazard, and space.
  - Rescue equipment may include:
    - PPE
      - SCBA, full-body harness with lifeline
    - Emergency extraction equipment
      - Tripod, pulley, winch or hoist
    - Other equipment (First Aid)
• Fatal Fact #39

• An employee sitting in a looped chain was lowered approximately 17 feet into a 21-foot deep manhole. Twenty seconds later he started gasping for air and fell from the chain seat face down into the accumulated water at the bottom of the manhole. An autopsy determined oxygen deficiency as the cause of death.
• Review #4

• CSE Permit equipment:
  – Air Testing and monitoring
  – Communications
  – Ventilation
  – Personal Protection
  – Lighting
  – Barriers and flagging
  – Removal, such as ladders
  – Emergencies and rescue
  – Isolation
  – Lockout and Tagout

• Monitoring equipment must measure the hazards such as
  – oxygen,
  – flammability,
  – air contaminants,
  – radiation, and
  – extreme temperatures.
Review #4

• Review #4
• Consider the following in choosing communications equipment:
  – the size and shape of confined space
  – the number of entrants
  – the lighting
  – Systems may include voice, hand signals, walkie talkies, radios, and horns and alarms.

• PPE
  – Use engineering and work practice controls first.
  – Select for all parts of body.
  – Respirators: Supplied air (supplies air with oxygen) and air purifying (filters out contaminants)

• Rescue equipment may include:
  – PPE
  – Emergency tripod, pulley, winch, or hoist
  – First-aid equipment
CSE Team

• Duties of Authorized Entrants, Attendants, Entry Supervisor
• Before, during and after a confined spaces in construction activity.
• All must have been trained and approved to enter a confined space.
  – Training regarding the potential hazards of the confined space, signs and symptoms of overexposure to any of the hazards.
  – They must be familiar with all equipment, know how to communicate with each other, know actions to take during a mishap or emergency and be trained and informed on the duties of others on the entry team.
• Let’s take a few minutes for a closer look at these duties.
CSE Team

- CSE team guidelines
  - The team must
    - be established before entry,
    - be trained in CS and permit system, and
    - include
      - an entry supervisor,
      - an entrant,
      - an attendant, and
      - response personnel.

TIP: A "competent person" must conduct the initial construction jobsite evaluation. The OSHA confined spaces standard that applies to the manufacturing & GI standard does not specify who has to conduct the evaluation. The competent person approach is common in construction industry rules.
The Supervisor

- Qualifications/responsibilities include
  - possessing training and experience in confined spaces,
  - ensuring safe entry conditions are met,
  - completing and signing the entry permit,
  - cancelling permit when work completed/conditions change, and
  - coordinating rescue services.
CSE Team

• Entrant
  – Any employee who enters the confined space must
    • be trained in CSE,
    • use assigned equipment,
    • communicate with the attendant, and
    • exit the space immediately if a hazard arises.
• Communication
  – Entrant should notify attendant whenever
    • entrant recognizes a warning sign or symptom of exposure,
    • entrant detects a prohibited condition,
    • there is a loss of mental control or confusion, and/or
    • someone has difficulty performing assigned tasks.
CSE Team

• When to Exit
  – Entrants must exit a space whenever
    • an order or alarm to evacuate is given,
    • entrant recognizes a warning sign or symptom of exposure,
    • entrant detects a prohibited condition, and/or
    • work is completed.

Safety Tip
Personal four-gas monitors are now available for continuous entry operations. These devices can simultaneously monitor for Oxygen, flammable gas, H2S and carbon monoxide.
CSE Team

• Attendant
  – has a vital role in CSE program,
  – must be trained as part of the CSE team,
  – must know the hazards of a confined space entry,
  – recognizes possible behavioral effects of exposure,
  – maintains an accurate account of all entrants,
  – communicates with entrants, and
  – remains outside space unless relieved by another attendant.
• Attendant Duties
  – Attendant must:
    • monitor activities inside and outside space,
    • summon rescue and other emergency services if necessary,
    • warn unauthorized entrants,
    • perform non-entry rescues, and/or
    • may not perform other duties that may interfere with their attendant duties.
  – The attendant DOES NOT ENTER THE SPACE (unless replaced).
CSE Team

• Rescue Team
  
  – Rescue team must be
    • identified before entry,
    • specially trained in CSE, and
    • consist of
      – an outside contractor,
      – an internal team,
      – a community fire/rescue emergency responders.

TIP: The construction rule explicitly requires employers to coordinate emergency services before workers enter the confined space.
CSE Team

- Detecting a hazardous atmosphere
  - All team members are involved in hazard detection.
  - If hazardous atmosphere detected, all entrants must exit the space.
  - Do not re-enter space until it is re-evaluated and hazards controlled.
The CSE team must be established before a permit is signed and includes entry supervisor, entrant, attendant, and response personnel.

CSE Supervisor
- ensures safe entry conditions are met,
- completes and signs entry permit,
- cancels permit
- coordinates rescue services
Review #5

• Review #5

• CSE Attendant:
  – has vital role in CSE program,
  – must be trained as part of the CSE team
  – must know hazards of a confined space entry
  – recognizes possible behavioral effects of exposure
  – maintains an accurate account of all entrants
  – communicates with entrants
  – remains outside space

• CSE Rescue Team:
  – identified before entry
  – specially trained in CSE may be outside contractor, a community emergency service, or internal rescue team.
Training Requirements

• Training
• The employer must provide training to each employee whose work is regulated by this standard, at no cost to the employee, and ensure that the employee possesses the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this standard.

• This training must result in an understanding of:
  – The hazards in the permit space
  – Methods used to isolate, control or in other ways protect employees from these hazards
  – For those employees not authorized to perform entry rescues, in the dangers of attempting such rescues.
Training Requirements

• Training must be provided to each affected employee
  – 1. In both a language and vocabulary that the employee can understand;
  – 2. Before the employee is first assigned duties under this standard;
  – 3. Before there is a change in assigned duties;
  – 4. Whenever there is a change in permit space entry operations that presents a hazard about which an employee has not previously been trained; and
  – 5. Whenever there is any evidence of a deviation from the permit space entry procedures required or there are inadequacies in the employee’s knowledge or use of these procedures.
Training Requirements

- Training proficiency and documentation
- The training must establish employee proficiency in the duties required and must introduce new or revised procedures, as necessary, for compliance with this standard.
- The employer must maintain training records to show that the training required has been accomplished.
  - Each employee’s name, the name of the trainers, and the dates of training.
  - Must be available for inspection by employees and their authorized representatives, for the period of time the employee is employed by that employer.
Rescue

• Rescue priorities/principles
  – Perform self-evacuation if possible.
  – Self-evacuation is most the effective and safest way to exit.
  – Attendant uses extraction device.
  – Attendant is not to enter confined space.
  – If rescue is not possible, call emergency rescue services.
Rescue

- Emergency On-site Rescue Team
- Have all equipment and training at no cost to those rescue employees:
  - Have PPE needed to conduct permit space rescues safely and trained to proficiently use that PPE;
  - Trained to perform assigned rescue duties.
- Trained in basic first aid and cardiopulmonary resuscitation (CPR).
- Affected employees must practice making permit space rescues before attempting an actual rescue, and at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces with limited exception.

TIP: Representative permit spaces must, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.
Rescue

• Employer-approved off-site services
  – The rescue service must:
    • be a qualified, trained and equipped personnel/provider
    • be able to respond quickly
    • be informed by employer of hazards
    • have access to onsite confined space to practice rescue operations
    • be trained in basic first-aid and CPR

TIP: Evaluate a prospective rescuer’s ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified. What will be considered timely will vary according to the specific hazards involved in each entry. For example, an employer must provide a standby person or persons capable of immediate action to rescue employee(s) wearing respiratory protection while in work areas defined as IDLH atmospheres.
Special Considerations

• Consult with Affected Employees

• Employers must consult with affected employees and their authorized representatives on the development and implementation of all aspects of the permit space program required by §1926.1203 of this standard.

• Employers must make available to each affected employee and his/her authorized representatives all information required to be developed by this standard.
Special Considerations

• Reclassification
  – Any change to the permit requires reclassification.
  – Changes may require
    • a new permit or
    • reclassification as non-permit confined space.
Special Considerations

- Special tasks
  - Avoid/control special hazards for hot work, such as welding or brazing
    - Use a permit
    - Control gases
  - Abrasive work, such as sanding, chipping, grinding
    - may release toxic or flammable residues or scale.
Special Considerations

• Using hazardous substances
  – Hazardous substances (solvents, paints, epoxies) are sometimes used inside the confined space.
  – Activities must be included on the permit and the resulting exposures controlled.
  – Review SDS or MSDS.
Special Considerations

• Completion of work
  – What to do when a job is complete
    • Secure the space.
    • Remove isolation and lockout/tagout materials and equipment if necessary.
    • Secure cover plates and doors.
    • Remove flagging and barriers.
  – Supervisor signs the permit, which is maintained for a minimum of one year.
Special Considerations

• Confined spaces: summing up
  – Permit-required confined space work is hazardous.
  – It requires planning, training, and proper equipment.
  – Never enter a permit-required confined space unless you are part of the CSE team.
  – Comply with OSHA regulations and your employer’s safety program.
  – Talk with your supervisor or safety coordinator.

Safety Tip: Click on the following link to view OSHA’s permit-required confined spaces flow chart http://www.labtrain.noaa.gov/osha600/refer/menu10a.pdf.
• Review #6
• Self-evacuation is most effective but if not possible, the attendant should attempt to extract the entrant with a hoist or other acceptable system.
• The attendant is not to enter the space.
• If entry rescue is necessary, the attendant must call emergency rescue services.
• Rescue teams:
  – On-site must be trained, have necessary rescue systems; and practice emergency rescue skills at least annually.
  – Off-site must be qualified, trained, equipped, able to respond quickly, be informed of hazards, have access to site for practice, be trained in first aid/CPR.
• Changes in a confined space may require a new permit or reclassification.
• Hot work requires a special permit.
• Hazardous substances. Control and list on permit, obtain SDS or MSDS.
• When the job is complete, secure space, remove isolation devices, cover plates and doors, sign and file permit (retain one year).
• Permit-required confined space work is always potentially hazardous. Never enter a confined a space without being part of a CSE team.
Conclusion

• Employer Responsibilities
• OSHA's Construction Regulations also contain ...
  
  – Requirements that employers must comply with dealing with confined space hazards in underground construction (Subpart S), underground electric transmission and distribution work (§1926.956), excavations (Subpart P), and welding and cutting (Subpart J).
  
  – Further guidance may be obtained from American National Standard ANSI Z117.1-1989, Safety Requirements for Confined Spaces. This standard provides minimum safety requirements to be followed while entering, exiting and working in confined spaces at normal atmospheric pressure.
Conclusion

- Summary
- We have familiarized you with
- an introduction to confined spaces,
- information concerning Confined Spaces in Construction,
- definitions,
- recognizing confined spaces hazards,
- confined spaces hazards control,
- confined spaces entry team,
- confined spaces equipment,
- rescue and special considerations, and

- Should you have any questions, you are encouraged to contact your supervisor, confined spaces Competent Person or designated Site Safety and Health Officer.