Overview

Lesson: Confined Spaces

Lesson Objectives:

- Define a confined space and explain what factors specify the requirement of a permit before entry.
- Discuss how the four primary risks from hazardous atmospheres cause asphyxiation, increased risk of fire and explosions, injury, and death from poisoning
- Discuss special concerns that general, physical, and miscellaneous hazards play in confined space work
- Define the safe levels of oxygen, explosive gases or vapors, and toxic gases or vapors; the devices and procedures for measuring the levels of each; and the order in which the measurements must be done

Topics

- Confined Spaces Overview
- Hazardous Atmospheres
- Other Hazards
- Ventilation and Air Monitoring
- PPE for Confined Spaces
- Permit-Required Confined Spaces

Topic: Confined Spaces Overview

Confined spaces don't always look dangerous, but they contain many potential hazards for anyone working in and around them. Because there are hundreds of different types of confined spaces, it may be hard to recognize a confined space and know all the hazards that you can encounter. This topic defines various types of confined spaces and what conditions cause a space to require a permit.

Having completed this topic, you should be able to:

- List three characteristics of a confined space
- Define what conditions may cause a space to require a permit
- Give several examples of spaces on a construction site that can be classified as confined spaces

Topic Summary

Please take a moment to review these major points before you continue with the next topic.

- There are numerous types of confined spaces in the construction industry.
- Confined spaces either have open tops and a depth that restricts the movement of air or are enclosed spaces with very limited entry openings.
- Confined spaces also may contain mechanical equipment with moving parts.
- Confined spaces are large enough and shaped so a person can work inside but are not meant for continuous worker occupancy.
- Examples of confined spaces include storage tanks, manholes, utility vaults, pipes, tunnels, pits, silos, and elevator shafts.

- Hazards in a confined space which may cause it to be classified as a permit space include hazardous atmospheres, material that could engulf, a shape that could trap or asphyxiate, or any other serious safety or health hazard to workers.

Topic: Hazardous Atmospheres

This topic introduces hazardous atmospheres as the greatest threat to worker safety. By defining oxygen deficiency and oxygen enrichment and describing flammable, combustible, and explosive measures of vapors and gases and toxic air contaminants, the topic gives the learner important guidelines that should always be monitored in confined space work.

Having completed this topic, you should be able to:

- Explain the difference between the terms *flammable* and *combustible*
- Describe how oxygen deficiency and oxygen enrichment cause hazards to the health of workers
- List some job-related activities that can cause oxygen deficiency
- Define what can occur at the LEL and UEL of chemicals
- Describe how the concept of vapor density can help understanding of where a particular gas may accumulate in a confined space
- Describe some job activities that can cause hazardous atmospheres in a confined space
- Explain some short- and long-term health effects of exposure to hazardous chemicals

Topic Summary

Please take a moment to review these major points before you continue with the next topic.

- Ninety percent of all confined space deaths are caused by atmospheric hazards!
- Always monitor the air to find the oxygen content of the confined space.
- Always use ordinary air to ventilate confined spaces; never use pure oxygen.
- Flammable materials burn more violently and ignite more easily in oxygen-enriched atmospheres.
- Flashpoint is the temperature at which a liquid chemical gives off enough vapors to burn if there is a source of ignition. The lower the flashpoint, the greater the fire hazard.
- Liquid chemicals with flashpoints below 100°F are called flammable because they are high fire risks.
- Do not operate a heater or motor inside a confined space.
- Rust, drying paint, cement, or caulking can increase the chances of oxygen deficiency.
- Welding, burning, and riveting inside confined spaces present major hazards and require special precautions and special hot work permits.
- An atmosphere becomes flammable when the ratio of oxygen to combustible material in the air is neither too rich nor too lean for combustion to occur.
- The upper explosive limit is the maximum concentration of a flammable gas/vapor in the air that will burn.
- The lower explosive limit is the minimum concentration of a flammable gas/vapor in the air needed for a fire or explosion.
- Acute health effects of toxic chemicals are the primary concern, because the symptoms of confusion, lack of coordination, and drowsiness could impair a worker's ability to escape from a confined space.

Topic: Other Hazards

Even though atmospheric hazards are the primary cause of confined space death, workers should recognize that many other hazards could exist in confined spaces. In this topic you will learn about such hazards.

Having completed this topic, you should be able to:

- List the three elements that can exacerbate potential hazards in confined spaces
- Describe the difference between clean air and oxygen and tell why oxygen is not used in forced ventilation

Topic Summary

Please take a moment to review these points before you continue with the next topic.

- When entering a confined space, you should anticipate that the most unfavorable situation exists in *every* case and that the danger of explosion, poisoning, and asphyxiation *will be present* at entry.
- All potential hazards must be evaluated and controlled before work inside the space begins.
- Incidents occur when people fail to recognize that a confined space is a potential hazard.
- The three elements that can dictate hazards in a confined space include the material stored or used, the activity carried out, and the external environment.
- Lack of ventilation can allow toxic gases/vapors to accumulate.
- Materials stored in the space or brought in by pipes can engulf entrants instantaneously.
- If all power sources are not locked out at the source, those sources can be turned on by people outside the space.
- Surface residues, scaffolding, and physical hazards can cause slipping and falls, electrical shock, chemical reactions, and physical disorders for the workers and illnesses that can be passed on to family members.

Topic: Ventilation and Air Monitoring

This topic explains the ventilation process and the necessity for monitoring the air in confined spaces. It also details what hazards to monitor for and what instruments to use in monitoring.

Having completed this topic, you should be able to:

- Specify the order of elements to test for when monitoring a confined space if possible hazards are unknown
- Identify two conditions that may require forced ventilation
- Describe types of hazards that can be introduced by forced ventilation of oxygen rather than normal air
- Define the common parts of an air monitor and how to check to see they are working
- Explain what hazard is avoided when an intrinsically safe instrument is used

Topic Summary

Please take a moment to review these major points before you continue with the next topic.

- The three atmospheric hazards of confined spaces are:
    - Too little or too much oxygen (oxygen deficiency or enrichment)
    - Explosive gases and vapors
    - Toxic gases and vapors
- Acceptable levels for oxygen fall between 19.5 and 23.5 percent.

- Acceptable levels for explosive gases or vapors should be less than 10 percent of the lower explosive limit (LEL).
- Acceptable levels for toxic gases or vapors should be below OSHA's permissible exposure limit (PEL) for that particular chemical in parts per million.
- Three types of sensors are broadband, electrochemical cells, and combustible gas sensors.
- Air monitors should be equipped with both audible and visual alarms to warn you of a hazardous atmosphere.
- The alarm points on an air monitor should be set at the acceptable levels for oxygen, explosive or toxic gases or vapors specified above.
- Accuracy of detector tubes can be "off" as much as 25 percent because of various environmental factors.
- Monitors should be bench calibrated at least once every six months, and that date should be marked on the outside of the air monitor.
- Air monitors must be zeroed every time they are used.
- Air monitors used in confined spaces that contain hazardous gases and vapors should be certified for Class I, Division 1 and 2, Group A, which covers all explosive gases and vapors.
- Intrinsically safe equipment will not provide a spark that can ignite explosive vapors or gases.
- Before beginning forced ventilation, consider the elements involved in the confined space that might exacerbate other hazards.
- Air is defined as approximately 20.9 percent oxygen, 78.1 percent nitrogen, and 1 percent argon, with small amounts of various other gases.

Topic: PPE for Confined Spaces

This topic describes the personal protective and communications equipment you may need for safe confined space entry. It contains a brief overview of the OSHA Respiratory Protection Standard, but it does not provide complete information on respirators.

Having completed this topic, you should be able to:

- Describe the primary protection offered by PPE used in confined space work
- Explain the different functions performed by APRs and SARs
- List some employer requirements of the OSHA Respiratory Protection Standard

Topic Summary

Please take a moment to review these major points before you continue with the next topic.The chemical PPE needed for entry must appear on the entry permit.

- When you wear a Level A chemical protective suit, you must use an SCBA inside the suit.
- Some Level B suits are fully encapsulating but not gas and vapor-tight.
- According to the Permit-required confined spaces (PRCS) standard, entrants and attendants must be in contact with each other so the attendant can make sure the entrant is OK.
- Alarms worn by the entrant can be set to go off if he doesn't move for a set period of time.
- An airline respirator requires an escape bottle containing about five minutes of breathing air.

Topic: Permit-Required Confined Spaces

This topic describes the requirements of the OSHA Permit-Required Confined Space Standard. It defines the responsibilities of the employer and the employee for permit spaces.

The goal of this topic is to explain standard safety procedures that should be followed for all confined spaces, not just permit space entries.

Overview

Having completed this topic, you should be able to:

- Discuss what types of information are required on the entry permit
- Discuss the primary responsibilities of the entrant, attendant, and supervisor when working in and around the space
- Describe the training requirements for workers and emergency personnel

Topic Summary

Pease take a moment to review these major points before you continue with the next topic.

- According to OSHA, entrants must know:
    - Confined space hazards, including information on the mode of exposure (that is, inhalation or skin absorption, signs or symptoms, and consequences of the exposure)
    - Appropriate use of equipment for confined space work
    - When evacuation is required
- A permit-required confined space:
    - Contains material such as grain or water that could engulf an entrant
    - Has a shape such as a sloping floor or converging walls that could trap or suffocate an entrant
    - Contains any other recognized serious safety or health hazard
- The OSHA standard for permit spaces includes responsibilities for employers and workers to create plans, procedures, and written policies, test for safety, monitor and assure safety, post signs, and train and protect those who will be working in confined and permit spaces.