

# Confined Space Entry

OSHA Standard 1910.146



Department of Facilities Management  
Office of Environmental Safety & Health

# OSHA Standard

**All employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required.**

# Confined Space Entry

- The **entrant** is the person who enters a confined space.
- The **attendant** is the person who stays with the entrant outside the confined space, and is responsible for assisting the entrant in exiting the confined space, and calling for emergency assistance when required.
- The **entry supervisor** is the qualified person who evaluates the hazards, prescribes required equipment and precautions and issues the Confined Space Entry Permit.

# How to Identify Confined Spaces

1. Limited openings for entry and exit; AND
2. Large enough and so configured that an employee can bodily enter and perform assigned work; AND
3. Not designed for continuous worker occupancy.

# 1. Limited Openings for Entry/Exit

- Openings as small as 18 inches in diameter.
- Difficult to enter with SCBA or other life-saving equipment.
- Difficult to remove downed worker in folded up or bent over position.
- Exit from large openings may be difficult due to presence of ladders, hoists, etc.

## 2. Large Enough to Enter & Perform Work

- If any part of the human body passes a plane of the equipment or space, it is considered an entry.

### 3. Not Designed for Continuous Worker Occupancy

- Most confined spaces are not designed to enter and work in on a regular basis.
- Designed to store a product.
- Enclose materials or processes.
- Transport products or substances.
- Occasional worker entry for inspection, repair, cleanup, maintenance, etc.

# Dangerous Combinations

- Presence of all three confined space characteristics can complicate the situation.
- Working in and around the space.
- Rescue operations during emergencies.
- Worsened conditions due to work activities:
  - Welding and cutting, use of bonding agents
  - Cleaning with solvents, use of other chemicals
  - Use of gas-powered equipment



# Typical Confined Spaces

- Boiler, Degreaser, Furnace
- Pipeline, Pit, Pumping Station
- Reaction or Process Vessel, Mills
- Septic Tank, Sewage Digester
- Silo, Storage Tank, Barges
- Sewer, Utility Vault, Manhole
- Trenches, Shafts, Caissons

# Categorizing Work Space

- \* Limited or restricted entry or exit;
- \* Large enough to enter & work; and
- \* Not designed for continuous worker occupancy.

NO

**Not a Confined Space**

YES

**Confined Space**

**Permit-  
Required  
Confined  
Space**

YES

**Hazardous Atmosphere**

Or

**Engulfment Hazard**

Or

**Configuration Hazard**

Or

**Any other recognized  
serious hazard**

NO

**Non  
Permit  
Required  
Space**

# Hazards of Confined Spaces

- Oxygen Deficient Atmospheres
- Oxygen Enriched Atmospheres
- Flammable Atmospheres
- Toxic Atmospheres
- Temperature Extremes
- Engulfment Hazards
- Noise, Slick/Wet Surfaces, Falling Objects

# Oxygen Deficient Atmospheres

<b>19.5 %</b>	<b>Minimum acceptable oxygen level.</b>
15 - 19%	Decreased ability to work strenuously. Impaired coordination. Early symptoms.
12-14%	Respiration increases. Poor judgment.
10-12%	Respiration increases. Lips turn blue.
8-10%	Mental failure. Fainting. Nausea Unconsciousness. Vomiting.
6-8%	8 minutes - fatal, 6 minutes - 50% fatal. 4-5 minutes - possible recovery.
4-6%	Coma in 40 seconds. Death.

# Oxygen Enriched Atmospheres

- Oxygen level above 23.5%.
- Causes flammable and combustible materials to burn violently when ignited.
- Hair, clothing, materials, etc.
- Oil soaked clothing and materials.
- Never use pure oxygen to ventilate.
- Never store or place compressed tanks in a confined space.

# Flammable Atmospheres

- Critical Factors:
  - Oxygen content in the air
  - Presence of a flammable gas or vapor
  - Presence of dust (visibility of 5' or less)
- Proper air/gas mixture can lead to explosion
- Typical Ignition Sources:
  - Sparking or electric tool
  - Welding / cutting operations
  - Smoking



# Toxic Atmospheres

- Product stored in a confined space:
  - Gases released when cleaning.
  - Materials absorbed into walls of confined space.
  - Decomposition of materials in the confined space.
- Work performed in a confined space:
  - Welding, cutting, brazing, soldering.
  - Painting, scraping, sanding, degreasing.
  - Sealing, bonding, melting.
- Areas adjacent to a confined space.

# Hydrogen Sulfide

- Decomposition of materials. Human waste.
- Rotten egg odor at low concentrations.
- Possibly no warning at high concentrations.

<u>PPM</u>	<u>Effect</u>	<u>Time</u>
10 ppm	Permissible Exposure Level	8 Hours
50 - 100	Mild Irritation - eyes, throat	1 Hour
200 - 300	Significant Irritation	1 Hour
500 -700	Unconsciousness, Death	1/2 - 1 Hour
>1000	Unconsciousness, Death	Minutes



# Carbon Monoxide

- Odorless, colorless gas.
- Combustion by-product.
- Quickly collapse at high concentrations.

<u>PPM</u>	<u>Effect</u>	<u>Time</u>
50	Permissible Exposure Level	8 Hours
200	Slight headache, discomfort	3 Hours
600	Headache, discomfort	1 Hour
1000-2000	Confusion, nausea, headache	2 Hours
1000-2000	Tendency to stagger	1 1/2 Hours
1000-2000	Slight heart palpitation	30 Min.
2000-2500	Unconsciousness	30 Min.

# Confined Space Entry - Hazards

Manholes often remain covered for long periods of time. Naturally occurring toxins, such as hydrogen sulfide can accumulate inside of manholes.

Manholes may also accumulate highly flammable gases such as methane and ethane.



# Testing The Atmosphere

- Verify presence of safe work atmosphere.
- Test all areas of a confined space.
  - Top, middle, bottom
- Methane is lighter than air.
- Carbon monoxide is the same as air.
- Hydrogen sulfide is heavier than air.
- Oxygen deficiency.

# Ventilation

- First option to correct problems.
- Must be aware of hazards you are trying to correct in the confined space.
- Place air intake in a safe location to draw fresh air only.
- Continuous ventilation whenever possible.
- Retest the confined space before entry.

# Ventilation

If concentrations of materials are found to be at harmful levels, the confined space must be ventilated to remove them before entry.



Fresh outside air is blown into the space to dilute and remove contaminants, and supply oxygen.

# Other Hazards

- Noise

- Amplified due to acoustics within the space.
- Damaged hearing, affect communication.

- Slick / Wet Surfaces

- Slips and falls.
- Increased chance of electric shock.

- Falling Objects

- Topside openings expose workers inside confined space to falling objects.

# Temperature Extremes

- Extremely hot or cold temperatures.
- Steam cleaning of confined spaces.
- Humidity factors.
- Extremely cold liquids.
- Work processes inside the confined space can increase temperature extremes.
- Personal protective equipment.

# Engulfment Hazards

- Loose, granular materials stored in bins and hoppers - grain, sand, coal, etc.
- Crusting and bridging below a worker.
- Flooding of confined space.
- Water or sewage flow.



# Isolation

- Locking and tagging out electrical sources.
- Blanking and bleeding pneumatic and hydraulic lines.
- Disconnecting mechanical drives and shafts.
- Securing mechanical parts.
- Blanking sewer and water flow.
- Locking and tagging out shutoff valves.

# Respirators

- Air-Purifying Respirators
  - Filter dangerous substances from the air.
  - Must know the type and amount of hazardous substance present in the confined space.
  - NEVER use with oxygen deficiency!
- Air-Supplying Respirators
  - Deliver a safe supply of breathing air from a tank or an uncontaminated area nearby.
  - Must be adequately monitored.

# Permit Entry Systems

- Written permit signed by entry supervisor.
- Verifies pre-entry precautions have been taken and the space is safe to enter.
- Posted at entry to confined space.
- Specifies apparent hazards and corrective actions taken prior to entry.
- Requires termination of permit when task is completed or when new conditions exist.

# Entry Permit Requirements

- Date, location, and name of confined space.
- Purpose of entry and known hazards.
- Duration of entry permit time.
- Authorized entrants, attendants, supervisors.
- Air testing results - signature of tester.
- Protective measures to be taken.
  - Ventilation, Isolation, Flushing
  - Lockout / Tagout, Purging

# Entry Permit Requirements

- Name and phone numbers of rescue and emergency services.
- Communication procedures.
- Special equipment and procedures.
  - Personal protective equipment.
  - Alarm procedures.
  - Rescue equipment.
  - Respirators.

# Means of Egress

- A means must be provided for both safe normal entry or exit, and emergency extrication. Tripods with hoist, lifeline, and full body harness are often used for emergency extrication. Ladders may be used for ordinary entry and exit.



# Barriers to Opening



- Barriers to prevent passers-by and the curious from falling in the opening must be in place.
- Holes and openings must be closed or guarded when not attended.

# Warning Signs



- Place warning signs where pedestrians can see them.
- Signs must state the hazard and the action required.



# Standby / Rescue

- Attendant to remain outside the confined space and be in constant contact with the workers inside.
- Know emergency rescue procedures.
- 50% of workers who die in confined spaces are would-be rescuers.
- Trained in use of emergency rescue equipment and PPE.

# Emergency Procedures

- The attendant should attempt to remove the entrant from the confined space using, tripods, hoist, and lifelines.
- Attendants are NOT TO ENTER the confined space.
- Lethal hazards may be present within the confined space.
- Murray Fire Department should be called for rescue of entrant if needed.

# Training and Education

- All workers who must enter confined spaces.
- All attendants and rescue team members.
- Prior to initial work assignment.
- Retraining:
  - Job duties change.
  - Change in permit-space program.
  - New hazards are present.
  - Job performance indicates deficiencies.

# Summary

Confined space entry hazards can include:

- Toxic substance
- Oxygen rich or deficient atmosphere
- Engulfment
- Combustible gases or liquids
- Process or equipment related hazards
- Conditions change to become hazardous

# Summary

- Follow safety procedures before entry.
- If a permit is required, be sure it is in place.
- Confined spaces are required to be labeled.
- Attendant should never enter confined space.
- Murray Fire Dept should be called for rescue.
- Contact your supervisor when in doubt.