



# Confined Space Work, Hazards, and Safety Provisions

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# What is a Confined Space?

## **A Confined Space . . .**

- Is large enough an employee can physically enter and perform their assigned work
- Has limited or restricted means for entry or exit
- Is not designed for continuous employee occupancy

All the above must be true in order for a confined space to exist.



# What is a Permit Confined Space?

**A Permit-required confined space is a confined space that has one or more of the following characteristics:**

- Contains / potential to contain a Hazardous Atmosphere
- Contains a material that could engulf the entrant
- Internal configuration that could trap the entrant
- Contains any other serious safety or health hazard



# What is an Enclosed Space?

## **Unique space classified for the electric utility industry . . .**

- A space that contains electrical equipment and has the following characteristics:
  - Limited means of egress and entry
  - Designed for periodic entry under normal operating conditions
  - No hazardous atmosphere under normal operating conditions

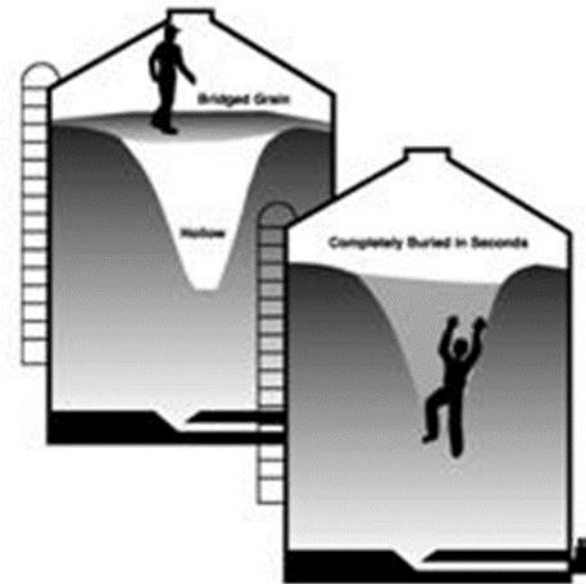
Examples of enclosed spaces include electrical manholes, vaults, tunnels, and shafts.

Enclosed spaces, such as vaults or manholes that contain electrical equipment, may be periodically entered alone for the purposes of reading meters, inspection or similar work unless there is an indicated danger such as a hazardous atmosphere or faulted equipment.

# Hazards of Confined Spaces

There are several potential hazards that need to be considered for confined space work

- Hazardous Atmosphere
- Physical Configuration
- Mechanical
- Electrical
- Engulfment





# Hazardous Atmosphere

"Hazardous atmosphere" is an atmosphere that may expose employees to the risk of death, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

- Oxygen Deficient (<19.5 % O<sub>2</sub>)
- Oxygen Enriched (>23.5 % O<sub>2</sub>)
- Flammable (> or = 10% LEL)
- Toxic Atmospheres
- Dust obscures vision at 5 feet

# Oxygen Deficient

An oxygen deficient atmosphere is any atmosphere containing  $< 19.5\%$  oxygen.

As the percent oxygen decreases it starts to have specific effects on the body:

**O2 Concentration**  
**21%**

Symptoms  
Natural air



**O2 Concentration**  
**18%**

Symptoms  
Limit level for not causing serious health problems. Continuous ventilation is required




**O2 Concentration**  
**16% - 12%**

Symptoms  
Rapid breathing,  
Increase in pulse rate,  
Loss of concentration,  
Headache, Nausea,  
Ear ringing



**O2 Concentration**  
**14% - 9%**

Symptoms  
Stupor, Headache,  
Nausea, Cyanosis,  
Faintness on the entire  
body



**O2 Concentration**  
**10% - 6%**

Symptoms  
Comatose, Loss of consciousness,  
Muscle spasm on the entire body



**O2 Concentration**  
**6% or less**

Symptoms  
Unconsciousness, Comatose,  
Cessation of breathing,  
Cardiac arrest, Die in 6 minutes





# Asphyxiation

**Reduction of oxygen in a confined space may be the result of either consumption or displacement.**

- Consumption of oxygen takes place during
- Combustion of flammable substances, as in welding, heating, cutting, and brazing
- Bacterial action, as in the fermentation process
- Chemical reactions
- **Asphyxiation is the leading cause of death in confined spaces**



# Oxygen Enrichment

## Oxygen concentration > 23.5%

- Causes flammable and combustible materials to burn violently when ignited
- Never use pure oxygen to ventilate
- Never store or place compressed gas cylinders in a confined space





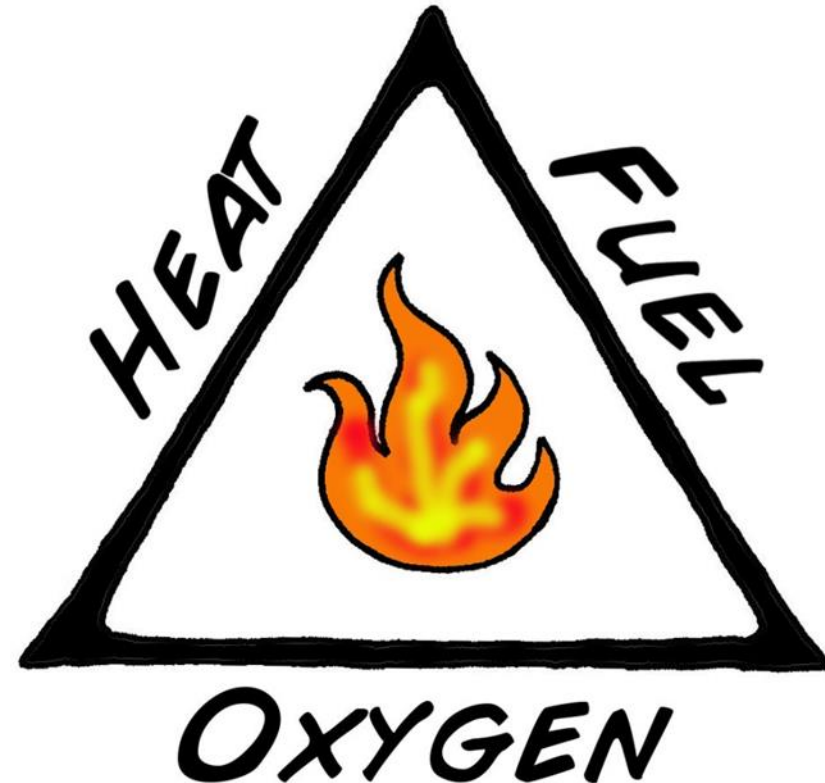
# Flammable Atmosphere

The triangle illustrates the three elements a fire needs to ignite.

A fire naturally occurs when the elements are present and combined in the right mixture.

A fire can be prevented or extinguished by removing any one of the elements in the fire triangle.

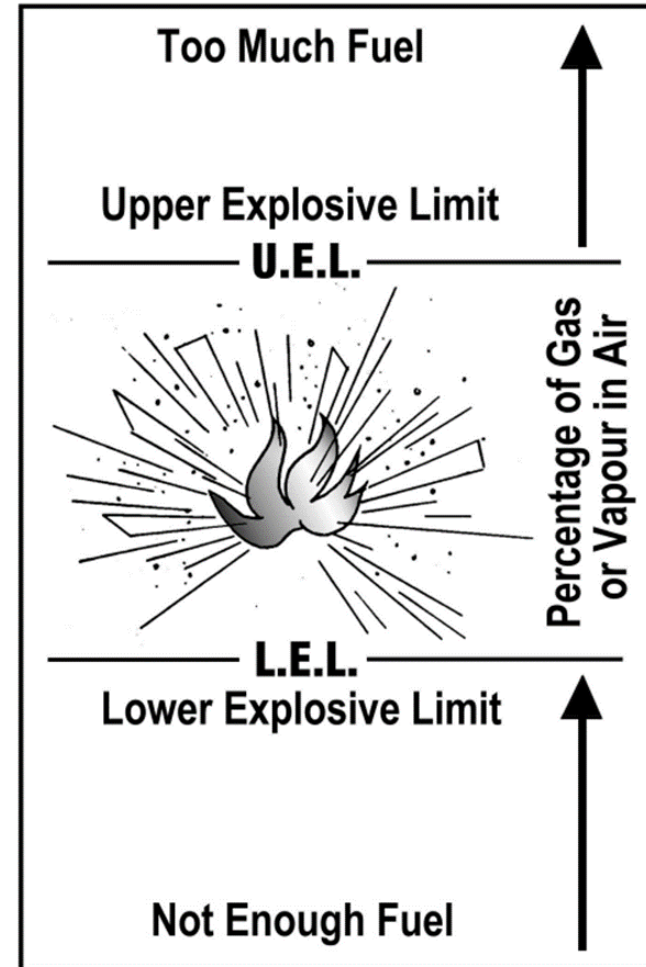
- Welding
- Electric Tools
- Sparks
- Smoking



# Flammable Atmosphere

Flammable Atmospheres can be caused by...

- Oxygen enriched atmospheres
- Vapors flammable liquids
- Byproducts of work
- Chemical reactions
- Concentrations of combustible dusts 10% LEL



# ↳ Toxic Atmospheres

Toxic atmospheres are most often created from the work being performed, for example:

- Welding, cutting, brazing, soldering
- Painting, scraping, sanding, degreasing
- Sealing, bonding, melting
- Cleaning





# Engulfment Hazards

Engulfment is the entrapment of a person by the contents of a space

- Liquids
- Small granular product such as grain
- Flooding

Completely empty the contents prior to entering

Use retrieval and fall arrest equipment to prevent sinking into contents of a space



# Air Monitoring

When entrance covers are removed, the opening must be promptly guarded.

Before an employee enters the space, the atmosphere shall be tested,

- for oxygen content,
- for flammable gases and vapors, and
- for potential toxic air contaminants, in that order.



# ALWAYS: Test Before Entering

Monitors must be calibrated on a monthly basis and bump tested prior to use.

Verify monitor function in clear air.



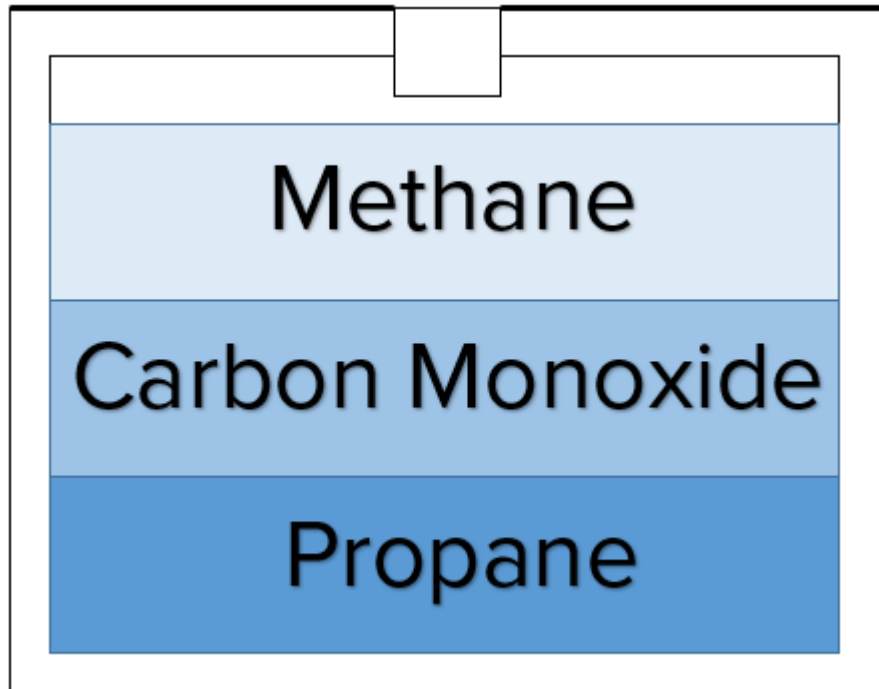


# Stratification of Gases

Chemicals stratify according to their vapor density.

Strata also changes based on environmental conditions.

At a minimum, samples must be taken at three levels from top to bottom.







Above the 10% LEL – Permit Required space until ventilated





# Roles and Responsibilities





# Entry Supervisors

Entry Supervisors are required to:

- Fill out and sign Permit Space Entry form before authorizing entry
- Verify adequate rescue services are available
- Verify acceptable entry conditions are present or cancel the entry
- Close off space once work is completed



# Attendant Responsibilities

Attendants are required to:

- Know the hazards and symptoms of exposure
- Maintain count of all persons in space
- Monitor activities inside and out of space
- Maintain effective communication
- Order entrants to evacuate
- Never enter space to rescue
- Properly use equipment



# Entrant Responsibilities

Authorized Entrants in confined spaces are required to:

- Identify space type
- Assess the hazards
- Be aware of the signs & symptoms
- Establish communication
- Select the proper equipment



# Confined Space Entry Procedures





# Confined Space Entry Procedure

1. Always test the air in the confined space prior to entering
2. Document air test results
3. The space may be entered after (all required):
  - Initial atmospheric check indicates there is no hazardous atmosphere
  - Work to be conducted in the space will not generate any other hazards and
  - It is verified there is no likelihood that a hazardous atmosphere, engulfment, entrapment could occur
4. This would not be considered a permit required confined space



# Permit Confined Space Entry Procedure

1. Always test the air in the confined space prior to entering to verify a hazardous atmosphere does not exist (test a minimum of three levels)
  - Oxygen, Combustible Gases (LEL), Toxic Gases (CO)
2. If a hazardous atmosphere, engulfment, entrapment, or other serious hazard exists in the space it must be considered a “Permit Confined Space.”
3. Fill out the Permit Space Entry Form
4. Mitigate Hazards:
  - Forced air ventilation, Continuous air monitoring, etc





## Permit Confined Space Entry Procedure Continue

5. Attendant must be readily available to monitor entrants, and perform rescue operations if needed
6. An effective means to rescue the entrants from confined space must be available and ready at the opening of the space. (may include SCBA, forced air respirator, harness/ lifeline)
7. Communication (face-to-face or radio)
8. The entrance to the confined space must be barricaded, or coned off to protect the entrants from unauthorized entrants, or other external hazards



# Rescue

Three types of rescue:

1. Self rescue (Preferred rescue method):

➤ This is when the entrant can escape the confined without the assistance of another person

2. Non-entry rescue(second best rescue method):

➤ When the entrant can connect themselves to rescue equipment and be lifted out without entry by other personnel

3. Entry rescue (limited capabilities):

➤ When personnel must enter the space to rescue a co-worker

➤ Cannot rescue in hazardous atmospheres

➤ Emergency services must be on stand by in these situations (i.e. hazardous atmosphere possible or present permit required confined space)

➤ Can rescue if atmosphere is verified clear



# Remember

All confined spaces are PERMIT SPACES until proven otherwise

Our goal is to never enter a PERMIT SPACE

➤ Asses hazards, remove the hazard, reclassify the space



Questions?