Confined Space
29 CFR 1910.146

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Confined Space vs. Permit- Required Confined Space

Confined Space

□ Is large enough and so configured that an employee can bodily enter it

AND

□ Has limited or restricted means for entry and exit

AND

□ Is not designed for continuous employee occupancy

Permit- Required Confined Space

□ Contains or has a potential of a hazardous atmosphere

□ Contains a material that has the potential for engulfing an entrant

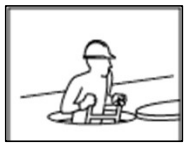
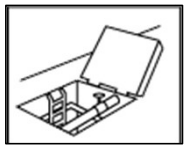
□ Has an internal configuration that could trapped or asphyxiated entrant

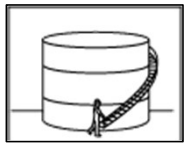
□ Contains any other recognized serious safety or health hazard

Must have 1 or More

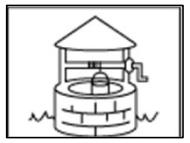
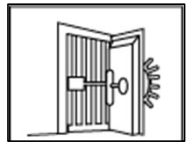
Confined Space Examples

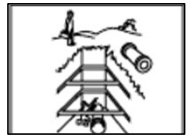
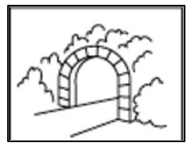
- Bins
- Boilers
- Pits
- Manholes
- Tanks
- Incinerators
- Scrubbers
- Sewers
- Transformer vaults
- Heating, ventilation and air-conditioning (HVAC) ducts
- Storm drains
- Water mains
- Concrete pier columns
- Precast concrete and other pre-formed manhole units

- Drilled shafts
- Enclosed beams
- Vessels
- Digesters
- Lift stations
- Cesspools
- Silos
- Air receivers
- Sludge gates
- Air preheaters
- Step up transformers
- Turbines
- Chillers
- Bag houses
- Mixers/reactors

Definitions

Definitions

Entry

- The action by which any part of a person passes through an opening into a permit-required confined space

- Whether or not such action is intentional or any work activities are actually performed in the space

Definitions

Qualified Person

- Possession of a recognized degree or certificate
- Has professional standing
- Has extensive knowledge, training, and experience
- Demonstrated the ability to solve or resolve problems

Definitions

Competent Person:

One who is capable of:

- Identifying existing hazards
- Able to predict hazards in the surroundings
- Identify working conditions which are unsanitary, hazardous, or dangerous to employees
- Has the authorization to take prompt corrective measures to eliminate them

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Employer Requirements

Employer Requirements

- Evaluate the workplace
- Posting danger signs or other equally effective
- Appropriate measures to ensure those spaces are not entered
- Establish an entry permit program

"Competent Person"

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Employer Requirements

Obligated to inform exposed employees of the danger posed by permit spaces

Warning signs that read:

- **DANGER- PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER** or other similar language would satisfy requirements for a sign

Shall appear in English and in the “predominant language of non-English reading workers”

Employer Requirements

- Implement measures to prevent unauthorized entry
- Identify and evaluate the hazards of permit spaces
- Develop and implement the means, procedures, and practices necessary for safe entry
- Provide the appropriate equipment
- Provide at least 1 attendant outside the permit space
- Provide a means by which an attendant can respond to an emergency
- Designate the persons, duties and provide training required

Confined Space Program Requirements

Confined Space Program Requirements

- Developed Procedures
  - The Who's and How's to summoning emergency services
    - When a failed non-entry rescue occurs
    - Rescuing entrants from permit spaces is required
    - Providing necessary emergency services to rescued employees

Confined Space Program Requirements

- Key Personnel
  - Duties are assigned prior to the entry operations, all must have received prior training:
    - Entry supervisors
    - Attendants
    - Entrants
    - Persons who test or monitor the atmosphere in a permit space

Entry Supervisor Duties

- Know the space hazards
- Understand signs and symptoms of exposure
- Understand consequences of exposure
- Determine that acceptable entry conditions are maintained throughout the duration of the entry

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Entry Supervisor Duties

- Orders immediate evacuation of space, cancel or suspend permit when:
  - A prohibited or unsafe condition arises in or near the permit space
  - Entry operations are completed
  - **Must fully reassess the space before allowing reentry**
- Verify that all tests specified by the permit have been conducted
- Verify all procedures and equipment specified by the permit are in place before allowing entry to begin
- Verify that rescue services are available and operable
- Remove unauthorized individuals who enter or attempt to enter the permit space during entry operations

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Attendant Duties

- There must be at least one attendant on each Permit Required Confined Space team.

- The attendant, arguably has the most amount of responsibility on the confined space team, as they have the highest number of duties required by OSHA.

- Remain outside the space until relieved
  - Once an Attendant has been relieved by another attendant, the relieved attendant may enter a permit space to attempt a rescue

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Attendant Duties

- Know the space hazards
  - Monitor the conditions inside and outside the space to determine if it is safe for entrants to remain in the space
- Maintain an accurate count of authorized entrants in the permit space and be able to identify each entrant
  - Maintain communication at all times
- Understand signs and symptoms of exposure
  - Understand consequences of exposures
  - Be aware of possible behavioral effects of hazard exposure in authorized entrants
- Can order immediate evacuation of space

Attendant Duties

- Summon rescue and other emergency services when entrants need assistance
- Perform non-entry rescue if necessary

THE ATTENDANT MUST NEVER ENTER THE SPACE FOR RESCUE WITHOUT FIRST BRIEFING AND BEING RELIEVED BY ANOTHER QUALIFIED PERSON!

- Warn unauthorized entrants to stay away from the permit space
  - Inform the entry supervisor if unauthorized entrants have entered the space
- Perform no duties that might interfere with primary duty to monitor and protect the authorized entrants

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Authorized Entrant Duties

- Know the space hazards
- Understand signs and symptoms of exposure
- Understand consequences of exposure
- Orders immediate evacuation of space
- Communicate with the Attendant
- Alert the Attendant whenever:
  - Recognize any warning sign or symptom of exposure
  - Detect a prohibited condition

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Authorized Entrant Duties

- Exit from the space when:
  - The attendant orders an evacuation
  - Recognize any warning signs of exposure
  - Detect a prohibited condition

Duties Review

Familiar with and Understood - Trained on the Responsibility	Entrant	Attendant	Supervisor
Space Hazards	X	X	X
Sign/Symptoms of Exposure	X	X	X
Consequences of Exposure	X	X	X
Proper Use of Equipment	X		
Communicates with Attendant	X		
Alert all for Evacuation	X	X	X
Detect Warning Signs of Danger	X	X	X
Aware of Behavior Effects of Exposure	X	X	
Accurate Count of Entrants in		X	
Accurate Identification of Entrants in		X	
Access Conditions Inside and Outside of Space		X	
Orders Immediate Evacuation of Space		X	X
Performs Non-Entry Rescue		X	
Performs No Other Duty than Assigned		X	
Summons Rescue Services for Help		X	X
Verifies Permit Information before Entry			X
Signs Entry Permit allowing Entry			X
Verifies Testing was Conducted			X
Procedures and Equipment in Place			X
Terminate Entry, Cancels or Suspends Permit			X
Verifies Rescue Services are Available			X
Removes Unauthorized Individuals		X	X

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Permit System

Entry Permit

- The permit space to be entered
- The purpose of the entry
- Start date and time- End date and time
- Authorized attendant(s)
- The authorized entrants within the permit space
- Entry supervisor and the signature

CONFINED SPACE ENTRY PERMIT

THIS PERMIT MUST BE POSTED AT THE JOBSITE BEFORE AND DURING ENTRY. PERMIT IS GOOD ONLY FOR DATE INDICATED.

Location and Description of Space:_____

Purpose of Entry:_____

Permit Start Date & Time:_____ Permit End Date & Time:_____

Entry Supervisor:_____ Authorized Attendant(s):_____

Authorized Entrants (List by name)	*Time In*	*Time Out*	*Time In*	*Time Out*	*Time In*	*Time Out*	*Time In*	*Time Out*
1.								
2.								
3.								
4.								

PERMIT SPACE HAZARDS

☐Oxygen Enriched (>23.5%) ☐Entrapment
☐Oxygen Deficient (<19.5%) ☐Engulfment
☐Flammable Atmosphere ☐Electrical
☐Toxic Gases or Vapors ☐Other_____
☐Hazardous Chemicals ☐Other_____
☐Energized Equipment

SPECIAL REQUIREMENTS

☐Signs Posted ☐Ventilation ☐Head Protection
☐Fire Extinguisher(s) ☐PPE ☐Eye/Face Protection
☐Lockout/Tagout ☐Respirators ☐Protective Clothing
☐Tripod Retrieval Unit ☐Self-Contained Breathing Apparatus
☐Spark Resistant Lighting ☐Hot Work _____
☐Barricades ☐Other_____

Test For:	*Permissible levels*	*Pre-Entry Levels*	*Levels After Isolation & Ventilation*	*Periodic Check* Time/Result*	*Periodic Check* Time/Result*	*Periodic Check* Time/Result*
Oxygen	19.5%-23.5%					
Carbon Monoxide	<35ppm					
Hydrogen Sulfide	<10ppm					
Lower Explosive Limit	<10%					
Other:						

*OSHA's CFR 1926 Subpart AA requires continuous monitoring of the atmosphere within the confined space. See regulation for more details.

Means for detecting an increase in atmospheric hazard levels in the event the ventilation system fails:_____

Equipment Name	*Type*	*Date Calibrated*

Atmosphere Tested By:_____

COMMUNICATION MEASURES

☐Visual ☐Pager ☐Voice ☐Radio/Cell

Procedures:_____

EMERGENCY PROCEDURES

Fire Department should be notified prior to entering confined space. If an emergency situation should occur, DO NOT ATTEMPT TO ENTER SPACE. CALL 911 IMMEDIATELY FOR RESCUE SERVICES.

Entry Permit

- Permit space hazards
- Means of detecting an increase in atmospheric hazard levels
- Measures to isolate the permit space
- Eliminate or control permit space hazards
  - Lockout or tagging equipment Procedures for:
    - Purging
    - Ventilating
    - Flushing

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Purpose of Entry:_____

Permit Start Date & Time:_____ Permit End Date & Time:_____

Entry Supervisor:_____ Authorized Attendant(s):_____

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☐Hazardous Chemicals ☐Other_____
☐Energized Equipment

SPECIAL REQUIREMENTS

☐Signs Posted ☐Ventilation ☐Head Protection
☐Fire Extinguisher(s) ☐PPE ☐Eye/Face Protection
☐Lockout/Tagout ☐Respirators ☐Protective Clothing
☐Tripod Retrieval Unit ☐Self-Contained Breathing Apparatus
☐Spark Resistant Lighting ☐Hot Work _____
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Entry Permit

- Acceptable entry conditions
- Results of tests and monitoring performed
- Additional permits- Hot Works

- Equipment needed- PPE, testing, communications
- Communication procedures
- Summoning rescue and emergency services

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EMERGENCY PROCEDURES

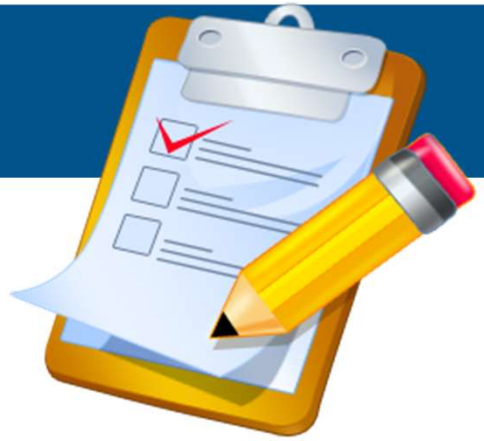
Fire Department should be notified prior to entering confined space. If an emergency situation should occur, DO NOT ATTEMPT TO ENTER SPACE. CALL 911 IMMEDIATELY FOR RESCUE SERVICES.

Entry Permit

- The permit must be displayed at the entry portal for the duration of the entry

- When the work is completed- the Entry Supervisor
  - Cancels the permit
  - Returns the confined space to service

Leaving Confined Spaces



- Accountability for all personnel
- Entrant informs the attendant when exiting
  - Attendant checks individuals off the list of entrants
- Remove all tools brought into the space
  - Tools left can cause great damage and are expensive to replace

Medical Issues

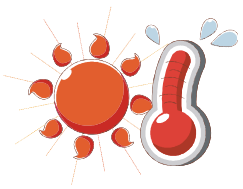
- Everyone needs to have a basic understanding of the types of medical emergencies they may encounter
  - Heart attack
  - Asphyxia
  - Chemical toxicity
  - Heat stroke
  - Burns
  - Fractures
  - Lacerations

- CPR and basic first aid training is recommended

Medical Issues

Signs and Symptoms of Heat Stress

- Body core temperature range 99.5°F to 102°F
- Confusion and poor judgment
- Loss of coordination

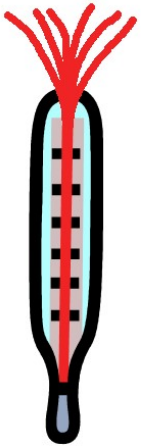


Signs and Symptoms of Heat Exhaustion

- Body core temperature range 102°F to 105°F
- Confusion and poor judgment
- Loss of coordination
- Decreased level of consciousness
- Pale, cool, sweaty skin
- Headache
- Muscular weakness
- Dizziness
- Profuse sweating
- Weak, rapid pulse
- Rapid, shallow breathing

Signs and Symptoms of Heat Stroke

- Body core temperature range above 105°F
- Decreased level or loss of consciousness
- Hot, dry skin
- Rapid pulse
- Rapid, shallow breathing
- Hypotension



Hazards of Confined Spaces

Hazards of Confined Spaces

- Atmospheric Hazards:
  - Oxygen Deficient/ Enriched
  - Flammable Atmosphere
  - Toxic Atmosphere

Too Little/ Too Much Oxygen

- Lack of oxygen is a leading cause of death among workers entering confined spaces.
  - Low oxygen levels cannot be detected by sight or smell.
  - You must test the air for this hazardous condition.
  - A very low level of oxygen can damage the brain and cause the heart to stop after a few minutes.

Effect of Oxygen Deficiency

19.5%	Minimum permissible oxygen level
16 – 19%	Decreased ability to work strenuously May impair coordination and induce early symptoms in person with coronary, pulmonary, or circulatory problems
13 – 16%	Respiration increases in exertion, pulse up, impaired coordination, perception, judgment
10-13%	Respiration farther increases in rate and depth, poor judgment, blue lips
8 – 10%	Mental Failure, Fainting, Unconsciousness, ashen face, blueness lips nausea, and vomiting
6 – 8%	8 minutes, 100% fatal 6 minutes, 50% Fatal 4 minutes, recovery with treatment
<6%	Coma in 1 minute, convulsions, death

What causes oxygen deficiency?

Here are some common causes of oxygen deficiency (not enough oxygen) 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.

Oxygen can be replaced by other gases — for example, welding gases or gases forced into the space to prevention corrosion.

Micro-organisms use up oxygen — for example, in sewer lines and fermentation vessels.

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Too Little/ Too Much Oxygen

Too much oxygen is not as common a hazard as low oxygen, but it is also dangerous.

Too much oxygen greatly increases the risk of fire or explosion in the confined space.

Materials that would not normally catch fire or burn in normal air may do so extremely quickly and easily where there is a high level of oxygen.

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The air may be toxic or explosive

Contaminants in the air can result in an atmosphere that is toxic to workers and may result in injury or death.

Some toxic gases typically found in confined spaces are:

Argon (Ar) ~ *Displaces Oxygen*
Carbon dioxide (CO_2) ~ *Displaces oxygen, toxic*
Carbon monoxide (CO) ~ *Toxic*
Chlorine (Cl_2) ~ *Toxic*
Gasoline Vapors ~ *Fire and explosion*
Hydrogen sulfide (H_2S) ~ *Flammable, toxic*
Methane (CH_4) ~ *Fire and explosion*
Nitrogen (N_2) ~ *Displaces oxygen*
Nitrogen dioxide (NO_2) ~ *Toxic*
Sulfur dioxide (SO_2) ~ *Toxic*
Oxygen (O_2) ~ *Low and High levels cause asphyxiate / explosion*

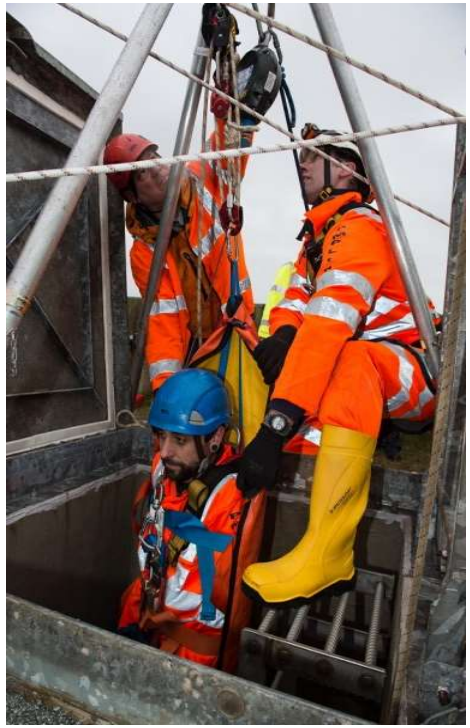
Physical hazards of confined spaces

What physical hazards do you come in contact with?

Dangers of a confined space rescue

Did you Know:

TWO-THIRDS of all confined space fatalities occur among would-be rescuers.



Who is a rescuer?

Anyone (workers, police, ambulance, fire, etc.) who attempts to save someone in a confined space.

If you come upon a scene where you hear of or see people who have succumb to vapors/fumes, etc. and are conscious or unconscious - **DO NOT** rush in. Analyze the environment to establish if the area may be a confined space or an exposure (ex. Carbon monoxide in a garage).

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Dangers of a confined space rescue

WHY HAVE CONFINED SPACES KILLED SO MANY PEOPLE?

Confined spaces are deceiving.

A confined space often appears to be harmless; no danger signs are apparent & the space may have been entered on prior occasions without incident. However, a worker cannot assume that conditions have not changed and that the space is safe for entry each time.

WHY DO SO MANY FATALITES RESULT FROM EMERGENCY RESCUE?

Fatalities can occur when the rescuers:

- ✓ Are overcome by their emotions
- ✓ Take unnecessary chances
- ✓ Do not know the hazards involved
- ✓ Do not have a plan of action
- ✓ Lack confined space rescue training

Unless properly trained on confined space entry, never attempt to enter a confined space for any reason.

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10 Basic Rules for Confined Space Entry

1. **Planning** by qualified person
2. **Training-** entry personnel, attendants, and rescue personnel
3. **Isolation** of Space
4. **Testing** of atmosphere
5. **Ventilation**
6. **Communication**
7. **Safety Equipment** and proper tools
8. **Entry permit**
9. **Periodic Monitoring** of atmosphere
10. **Rescue Plan and Equipment**

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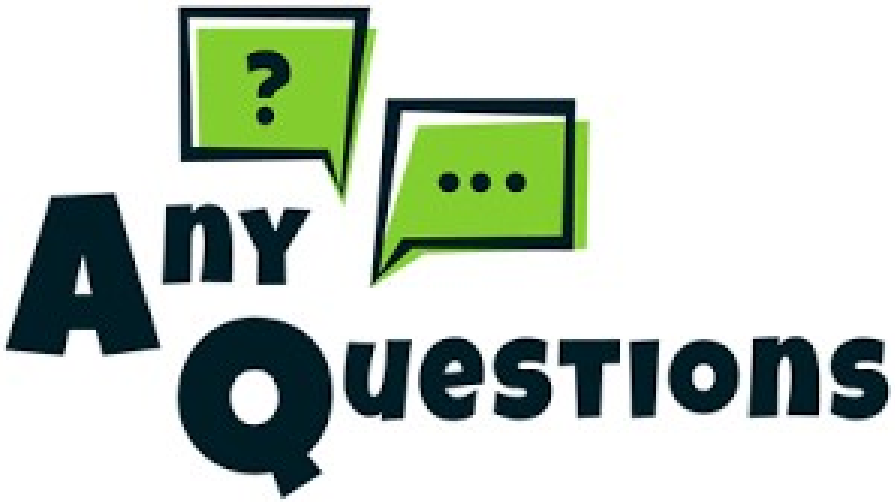
Thank you!



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