



# Confined Spaces and You

A confined space can be any space which has a limited means of exit, and where an oxygen-deficient, toxic or flammable environment may exist. They're spaces that aren't designed for normal human occupancy. Confined spaces can include:

- ✓ tunnels
- ✓ trenches
- ✓ pipelines
- ✓ underground utility vaults
- ✓ ventilation and exhaust ducts
- ✓ sewers
- ✓ storage bins
- ✓ manholes
- ✓ silos
- ✓ vats
- ✓ pits
- ✓ tubs
- ✓ tanks
- ✓ vessels
- ✓ vaults
- ✓ boilers

## CONFINED SPACES HAZARDS

- They may have too little or too much oxygen.
- They may contain explosive or combustible atmospheres.
- They may contain toxic substances.
- They may contain physical hazards such as live wires, moving parts, fall hazards or high levels of heat or noise.

*Describe confined spaces in your work area. Learn about the hazards, safety procedures and other requirements by reading the entry permits.*

Confined space: \_\_\_\_\_  
 Hazards: \_\_\_\_\_

Confined space: \_\_\_\_\_  
 Hazards: \_\_\_\_\_

Procedures: \_\_\_\_\_

Procedures: \_\_\_\_\_

Requirements (lockout tags, entry permit, barriers, attendants): \_\_\_\_\_

Requirements (lockout tags, entry permit, barriers, attendants): \_\_\_\_\_

# How Much Do You Know About Confined Spaces?

If you work in or around confined spaces, it's important to know what they are and what's dangerous about them. Use this quiz to test your knowledge of confined spaces.



**1. List four examples of confined spaces:**

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**2. List four hazards of confined spaces:**

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**3. What basic safety precautions should you take in a confined space?**

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**4. Name three things that may mean a space is a confined space?**

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**5. When must a confined space's air first be tested?**

- a. after entering the space
- b. after a confined space is exited
- c. before entering a confined space
- d. 24 hours before entering

**6. When testing the air of a confined space, what are you testing for?**

- a. density
- b. temperature
- c. hazardous toxic gases and other substances
- d. dust

**7. Signs that a confined space has a problem and could be deadly include:**

- a. total darkness.
- b. a distinct odor of a toxic atmosphere.
- c. an awkward shape.
- d. dust.

**8. Which of the following can cause dangerous vapors and gases to accumulate in a confined space?**

- a. welding
- b. tank coatings and preservatives
- c. previous contents
- d. all of the above

## ANSWERS:

- 1. Examples might include tanks, trenches, pits, vaults, silos, storage bins and hoppers.
- 2. Answers could include explosive or combustible hazards, asphyxiation, engulfment, toxic contaminants and physical hazards such as extreme temperatures, noise, moving parts and unsafe surfaces.
- 3. Always work with an attendant, monitor atmospheric conditions in the space, use proper personal protective equipment and follow entry

- permit and other established confined space safety and emergency procedures.
- 4. They're not designed for human occupancy. They have restricted entry or exit. They're big enough for a human to get into.
- 5. c
- 6. c
- 7. b
- 8. d.

# Confined Space Hazards: Engulfment, Physical Conditions and Oxygen Deficiency or Enrichment

Some hazards of confined spaces include engulfment, physical conditions and oxygen deficiency or enrichment. Know the hazards that are present in your confined work area and the precautions you'll need to take.

## ENGULFMENT HAZARD

Engulfment is when a person is suffocated or crushed by liquid or "flowing" solid material such as:

- dirt
- sand
- gravel
- cement
- asphalt
- powdered talc
- grain

### **Protect Yourself**

- Avoid entering a confined space when the potential for engulfment exists.
- If you must work in a situation where engulfment may occur, such as in a trench where a chance of a cave-in exists, be sure to consult and carefully follow the OSHA excavation rules for construction.

## PHYSICAL CONDITIONS

Physical conditions in confined spaces can create these hazards:

- **Extreme Temperatures:** Heat can increase quickly in a confined space and cause dizziness, exhaustion or heatstroke.
- **Noise:** High noise levels may keep you from hearing important warnings or instructions, and noise reverberation can cause hearing damage.
- **Pipes and Valves:** Entering gases or liquids can cause injury.
- **Awkward Positions:** Working in tight spaces and on platforms, sloping floors or ladders can lead to fatigue, falls or entrapment.
- **Electrical Equipment:** Live wires and energized equipment can kill you.
- **Underground Utilities:** Utilities containing hazardous materials, such as gases, steam and coolants, can be harmful.

### **Protect Yourself**

- Pipes and valves must be shut off, locked out, blanked and tagged.
- Avoid working in confined spaces when temperatures are extreme.
- Always wear appropriate personal protective equipment.
- Make sure all electrical, mechanical and hydraulic equipment in the space is properly de-energized and locked and tagged before you begin working.
- Have all underground utilities containing hazardous materials such as gases, steam or coolants shut off.
- Make sure you can communicate with your confined space attendant at all times.
- Use a harness or other fall protection equipment when there's a danger of falling.

## OXYGEN DEFICIENCY OR ENRICHMENT

Oxygen can be reduced in a confined space by being used up or replaced by another gas. Oxygen enrichment (too much oxygen in the air) is dangerous because it can be a fire hazard.

### **Oxygen Enrichment**

- Fires start much more easily in air with more than 23.5 percent oxygen. (Normal air contains 20.8 percent oxygen.)
- Oil in the presence of pure oxygen will self-ignite.

### **Causes of Oxygen Deficiency**

- **Fire or Explosion:** Oxygen is used up as fire burns. Activities such as welding, cutting and brazing use up oxygen.
- **Displacement:** Oxygen is sometimes replaced with a noncombustible gas such as argon, carbon dioxide or nitrogen to reduce the danger of explosion.
- **Rust:** When metals rust it takes oxygen out of the air.
- **Bacterial Action:** Oxygen is used for processes such as fermentation.

### **Protect Yourself**

- Make sure that the atmosphere is monitored during any confined space entry.
- Only enter an oxygen-deprived space if you have an outside source of breathable air.
- Ventilate oxygen-poor areas before entering them when possible.

# Confined Space Hazards: Toxic Contaminants and Explosive or Combustible Atmosphere

The hazards of confined spaces include toxic contaminants and explosive or combustible atmosphere. Know the hazards that are present in your confined work area and the precautions you need to take.

## TOXIC CONTAMINANTS

Confined spaces often contain toxic contaminants such as vapors, fumes or gases from previously stored materials or from the use of cleaning solvents, coatings or preservatives. Work such as welding in confined spaces can also produce toxic gases such as carbon monoxide. Remember, you can't always see or smell toxic substances. Some common toxins are:

- hydrogen sulfide.
- sulfur dioxide.
- carbon monoxide.
- oxide of nitrogen.
- oxide of ozone.

### Two Ways Toxic Materials Can Hurt You

- 1. Irritation:** The substance may irritate your respiratory system (throat, lungs) or your nervous system. If this irritation is extreme, it can be deadly.
- 2. Chemical Asphyxiation:** Some toxins can decrease your oxygen supply or get into your lungs and asphyxiate you.

#### *Protect Yourself*

Never rely on your own senses to detect toxic hazards. Before you enter a confined space, make sure:

- ✓ you know what hazardous substances are present and what levels are acceptable for entry.
- ✓ you know the health effects from exposure.
- ✓ you wear the appropriate personal protective equipment.
- ✓ ventilation is present if necessary.
- ✓ the atmosphere is monitored before and during entry.

## EXPLOSIVE OR COMBUSTIBLE ATMOSPHERE

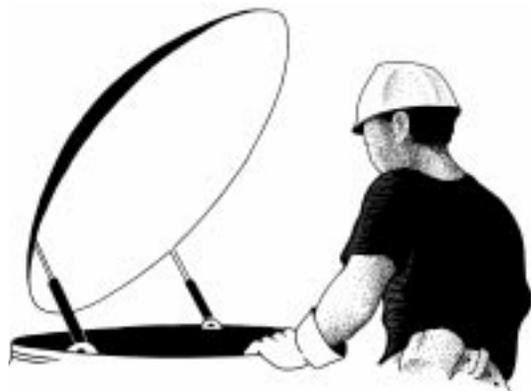
Fires and explosions are serious dangers in confined spaces. They can be caused by:

- flammable gases or vapors.
- chemicals.
- solvents.
- oxygen enrichment.
- petroleum products.

#### *Protect Yourself*

Provide continuous monitoring of the space if any hot work is necessary. Eliminate anything that can ignite vapors or gases in a confined area, such as:

- heat sources.
- sparks from machinery or tools.
- static electricity.
- friction.
- torch cutting.
- welding.
- hot surfaces.
- smoking.



# Confined Space Entry Permits

If a confined space is identified as a permit-required space, a written entry permit is required before a worker can go into the space. The entry permit should describe:

- the space to be entered.
- the reason for entering the space.
- the date of entry.
- the duration of entry.
- acceptable entry conditions.
- the hazards of the space and ways to control or remove them.
- the names of the workers entering the space, the attendants and the entry supervisors.
- information about atmospheric testing done on the space.
- appropriate communication procedures.
- information about rescue and emergency services.
- information about necessary equipment when entering the space.
- whether additional permits, such as permits for hot work, are needed.



## ENTRY PERMIT GUIDELINES

- An entry supervisor must fill out and sign the permit before any activity can begin.
- If problems occur during the work in the space, they must be recorded on the permit.
- Permits must be kept on file for at least one year.
- Warning signs must be posted at entrances to all permit-required spaces to let everyone know a written permit is needed before entry.

# Testing and Monitoring the Atmosphere

Everyone working in a permit-required confined space must be familiar with basic air monitoring. The space must be monitored before entry. Depending on the hazards and the type of work being performed, testing will be conducted either continuously or periodically. Confined spaces can be monitored for:



- ✓ oxygen deficiency or enrichment.
- ✓ fire or explosion hazards.
- ✓ toxic contaminants.

## TESTING GUIDELINES

### CONTINUOUS MONITORING IS REQUIRED IF:

- Test for sufficient oxygen and hazardous levels of toxic or combustible substances.
  - The air in the confined space should be tested from top to bottom since some gases such as butane and propane are heavy and will sink to the bottom.
  - Excavations more than 4 feet deep, where oxygen deficiency or other hazardous atmosphere exists or could exist, must also be tested.
- ventilation is necessary to control atmospheric hazards.
  - welding or other hot work is being done.
  - chemicals with airborne hazards are being used in the space for cleaning or other purposes.

# Controlling the Atmosphere

Atmospheric dangers are the primary hazards of permit-required confined spaces. Before anyone enters a confined space, atmospheric control measures must be taken. These controls are chosen based on the hazards present in the space and the type of work being done.

## INERTING

To help control the potential for explosion or fire, inerting is used to displace fuel or oxygen with nonflammable gas such as nitrogen, argon or carbon dioxide.

## VENTILATING OR PURGING

Purging or ventilating must follow inerting because inerting agents are colorless, odorless asphyxiants that can affect your breathing or even kill you. Purging is a process where breathing-quality air is added to the space. Ventilating removes contaminated air and replaces it with breathing-quality air. It's probably the best and most effective method of cleaning a hazardous atmosphere. A common method of ventilation uses a large hose with a fan attached to one end. The hose is placed in the confined space and the fan draws in fresh air from outside.

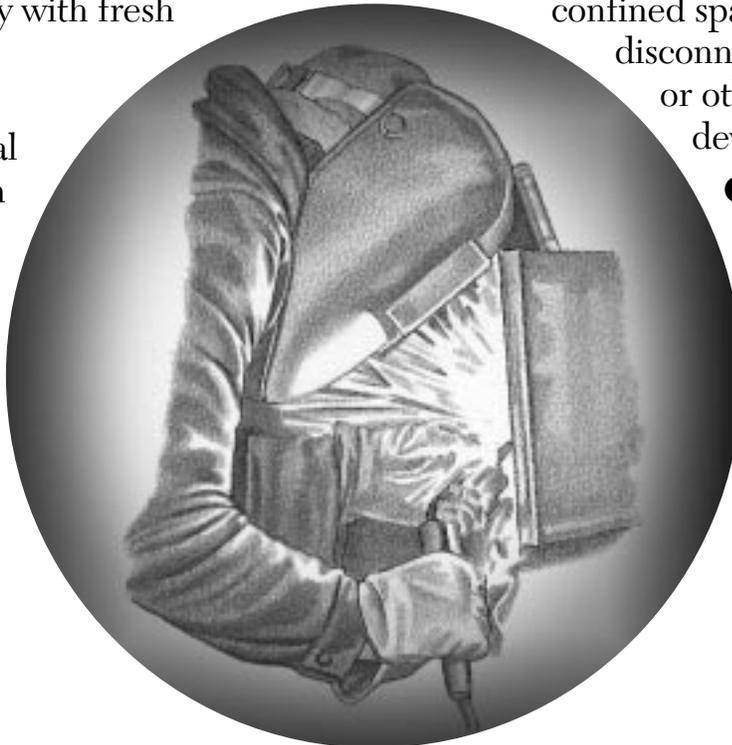


# Hot Work and Confined Spaces

When hot work activities such as welding, cutting and heating are done in a confined space, there are a number of potential dangers. It's important to follow all confined space safety regulations and guidelines to help reduce the risk of danger.

## WORKING SAFE

- Obtain entry and hot work permits for your confined space.
- Test the confined space's atmosphere for combustible gases and liquids. If flammable substances are found, have them removed entirely and then retest the site.
- Have emergency rescue equipment and personnel in place outside the confined space.
- Ventilate the confined space continually with fresh air.
- Use mechanical ventilation when the natural fresh air supply is not enough.
- Use air-line respirators when ventilation isn't adequate.
- A worker outside the space must stay in constant communication with the workers inside the space in case there is an emergency.
- Avoid taking cylinders containing oxygen, acetylene or other fuel gases into confined spaces.
- Immediately remove open-end fuel-gas and oxygen hoses from a confined space when they are disconnected from a torch or other gas-consuming device.
- When torches are not in use, close torch valves and remove the torches from the confined space.



# Confined Spaces: Know Your Role

When it comes to confined spaces, it's especially important to know the role you play. Each role—entrant, attendant, supervisor and rescue team member—is critical and each has a carefully defined set of responsibilities.

## ENTRANT

**An entrant is a person who goes into the space to do the work. Entrants must:**

- follow company procedures at all times.
- know the hazards of the space.
- know how to use equipment for entry and work in the space.
- perform assigned work in a safe, efficient manner.
- stay in communication with the confined space attendant.
- wear protective clothing and equipment such as harnesses, retrieval lines and respirators.
- alert the attendant to any danger.
- evacuate the space when ordered to do so.
- lockout/tagout all energy sources.
- make sure the area is tested and well-ventilated.



## ATTENDANT

**The attendant observes, assists and calls for rescue in case of emergency. The attendant must:**

- follow company procedures at all times.
- know all emergency procedures.
- monitor conditions in and around the confined space.
- know all the hazards of the space.
- stay in constant contact with workers in the confined space.
- assist the entrant as required.
- recognize signs that an entrant is in trouble.
- prevent unauthorized people from entering the space.
- be prepared to order an evacuation if necessary.
- never go inside to rescue anyone, but will call rescue personnel instead.



## SUPERVISOR

**The supervisor is responsible for the planning and completion of the confined space entry permit. The supervisor must:**

- follow company procedures at all times.
- know the hazards of the space.
- remove unauthorized people from the space.
- authorize the beginning and end of the entry permit.
- decide on all control measures such as lockout/tagout, isolation and ventilation and make sure that they've been completed.
- arrange for rescue services.
- ensure that rescue equipment is set up and ready to use.



## RESCUE TEAM

**The rescue team is responsible for rescuing the entrant if necessary. Team members must:**

- always follow company procedures.
- have the same level of training as entrants.
- know first aid and CPR.
- be able to use all necessary rescue equipment and rescue techniques.
- be able to understand the information given to entrants.



# Be Prepared for a Confined Space Emergency

It's no secret that confined spaces are dangerous places. Each year, approximately 54 workers die in confined spaces. Nearly two-thirds of these deaths result from people attempting to rescue workers in a confined space. Use the following guidelines when planning for confined space emergencies:

- **Establish written emergency plans for each type of confined space site and activity.**
- **Put together and thoroughly train a confined space emergency rescue team.**
- **Review emergency plans with workers and make sure each worker understands his or her role during an emergency.**
- **Whenever a worker is inside a confined space, make sure that at least one trained attendant (certified in first aid, CPR and rescue procedures) is on site and in constant communication with the confined worker. The attendant should communicate by radio, field telephone or sight, and must never leave the space or opening.**
- **Have emergency rescue equipment such as a self-contained breathing apparatus (SCBA), a safety harness and line (preferably a full-body harness and a lifeline attached to a block and tackle) or a basket stretcher readily available.**

