



CONFINED SPACE

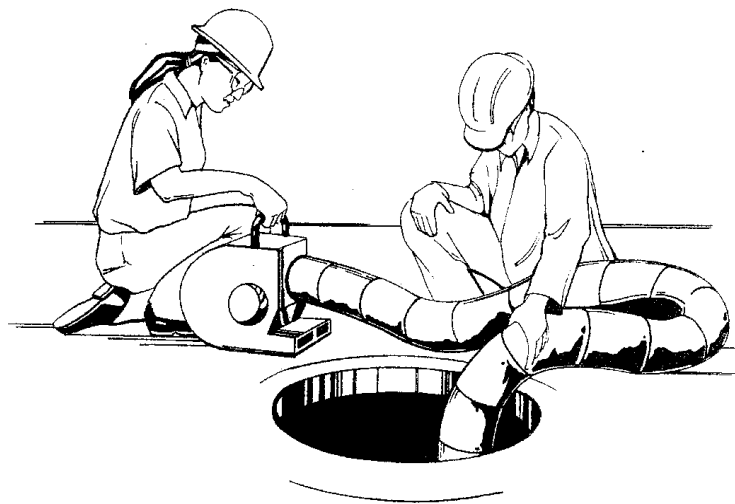


Permit Space Hazards

Atmospheric Hazards

Atmospheric hazards are the leading causes of confined space deaths and injuries. Most deaths related to atmospheric hazards are caused by asphyxiation (unconsciousness or death from lack of oxygen) due to poor ventilation of the confined space.

To prevent these deaths and injuries, you need to know when an atmosphere is unsafe. There are five main types of atmospheric hazards:



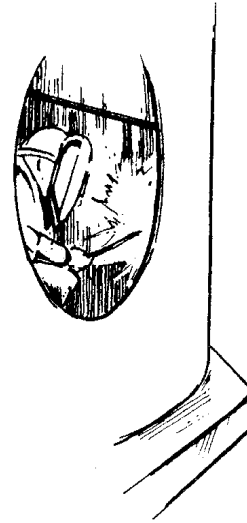
Oxygen Concentration

Too much or too little oxygen in a confined space can be hazardous. The oxygen level in a confined space must be between 19.5 percent and 23.5 percent.

•If the oxygen level falls below **19.5 percent**, the atmosphere is “oxygen deficient” and asphyxiation could occur—which may result in death.

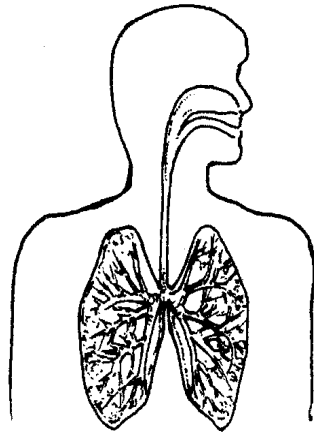
There are many causes of asphyxiating atmospheres, including materials that absorb the oxygen in the air, chemical reactions that consume the oxygen, gases that inert the atmosphere, and others. If the oxygen level cannot be brought up to an acceptable level, a self-contained breathing apparatus (SCBA) must be worn during entry.

•If the oxygen level reaches above **23.5 percent**, the atmosphere is “oxygen enriched” and could cause combustible materials present to explode if an ignition source is present. An ignition source could include sparks from welding, for example.



Flammable Gas, Vapor, or Mist

If the atmosphere contains flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL), that atmosphere is not acceptable for entry. LFL means the minimum concentration of a flammable material which will ignite if an ignition source is present. This information can be found in the Material Safety Data Sheets at your facility.



Toxic Air Contaminants

Toxic air contaminants must be within their permissible exposure limits in a confined space. The most common toxic gases in permit spaces are carbon monoxide and hydrogen sulfide.

When you breathe vapors in, they immediately enter the blood stream through your respiratory system and cause poisoning. This is why you should never stick your head inside a confined space just to check things out.

Inhaling toxic vapors is the second leading cause of deaths in confined spaces.



Permit Space Hazards

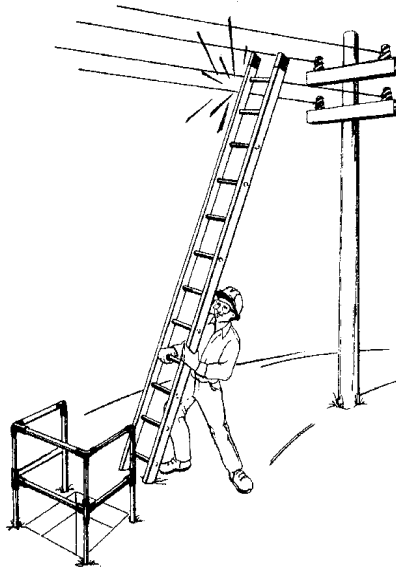
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Burns

Burns may result from falling or bumping against hot machinery or equipment. Other sources of burns could include steam, chemicals, electrical energy, and others.

Electrocution

Electrocution occurs when a worker or the equipment he is using comes in contact with electrical energy that has not been isolated or protected.



Other hazards related to confined space activities include heat stress, exposure to excessive noise, and back injuries. It is important to identify and evaluate all potential hazards and follow the necessary precautions to eliminate or control them.

Review

1. What potential atmospheric or safety hazards exist in the permit-required confined spaces at your facility?

2. Are there any job functions you may perform in confined spaces at your facility that could create hazards?



Entry Permit

Whether you enter a permit-required confined space to perform maintenance work, repairs, inspections or even new construction, an entry permit is required. The entry permit controls entry into a permit space and communicates all potential hazards to the worker. It also serves as a valuable checklist to make sure all necessary safety precautions are followed.

An entry permit provides the following information:

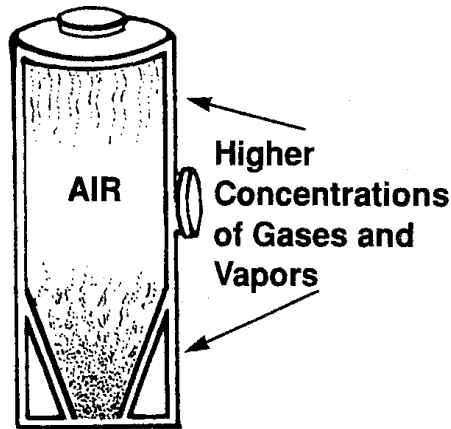
- The permit space to be entered and purpose of entry
- The date and authorized duration of the entry permit
- Authorized entrants, attendants, and entry supervisor
- The hazards of the permit space
- Measures taken to isolate the space and eliminate or control the hazards
- Acceptable entry conditions
- Results of initial and periodic tests performed, names and titles of testers, and when the tests were performed
- Rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) to do so
- Communication procedures used by authorized entrants and attendants to maintain contact during the entry
- Equipment required -- such as personal protective equipment, testing equipment, communication equipment, alarm systems, and rescue equipment
- Any other information needed to ensure employee safety
- Additional permits, such as hot work, that have been issued to authorize work in the permit space

Pre-Entry Procedures

Atmospheric Testing

Atmospheric testing of the atmosphere in a confined space is done before and during entry to make sure conditions are acceptable for entry. The entry permit lists the types of tests that should be performed. You should test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors. The testing results are listed on the entry permit along with the names or initials of the testers and when the tests were done.

Testing of gases and vapors should be done at different levels in the confined space because some gases and vapors are lighter or heavier than air. This may cause higher concentrations of environmental hazards at different levels in the space. Also, confined spaces with walls that slope inward may have a higher concentration of a hazard at the bottom of the confined space where the walls are closer together.



Where entry is vertical into a confined space, remote probes should be used to measure the atmosphere at different levels.

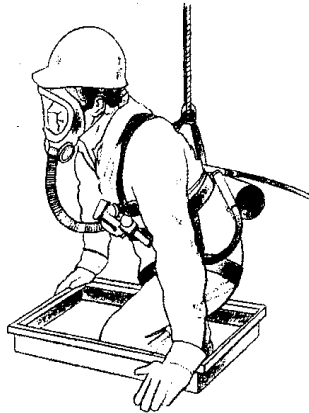
The atmosphere outside the confined space should also be tested to make sure the surrounding air is not contaminated. These tests must be done by a trained specialist who should also make sure all testing instruments have been properly calibrated.

The measures used to isolate the permit space and to eliminate or control permit space hazards before entry will be listed on the entry permit. These include the following methods:

• **Flushing or Purging** the confined space to get rid of gases, vapors or other airborne impurities.

• **Ventilating** the confined space. There are several methods for ventilating a confined space. The method and equipment you use will depend on the size of the confined space and the contaminants associated with it.

• **Inerting**, or making the atmosphere in the confined space non-flammable, non-explosive, or otherwise chemically non-reactive by displacing or diluting the original atmosphere with steam or a gas that is non-reactive to that space.



If atmospheric conditions cannot be brought into acceptable levels, then the space cannot be entered unless proper respiratory equipment is used. If a hazardous atmosphere is detected during entry, all authorized entrants must leave the space and measures must be taken to protect employees from the hazardous atmosphere before another entry takes place.

Isolation of Energy Sources

To prevent the accidental release of stored energy, you may need to isolate energy sources before entering. Isolation of a confined space is locking out and tagging all supply lines and sources of energy which may cause additional hazards. If these measures need to be taken, they will be listed on the entry permit. All potentially hazardous energy sources must be secured, relieved, disconnected and/or restrained. Energy sources may include electrical, mechanical, thermal, pneumatic, chemical and gravity. Methods for controlling or isolating hazards from the confined space include:

Pre-Entry Procedures

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Locking and tagging electrical power as close to the source as possible

Blanking or Blinding a pipe, line or duct by fastening a solid plate or "cap" over it after you depressurize and disconnect the contaminant supply lines

Double blocking and bleeding a line, duct or pipe by locking and tagging a drain or vent which is open to the atmosphere in the line between two locked-closed valves

Removing or misaligning pipe sections or spool pieces

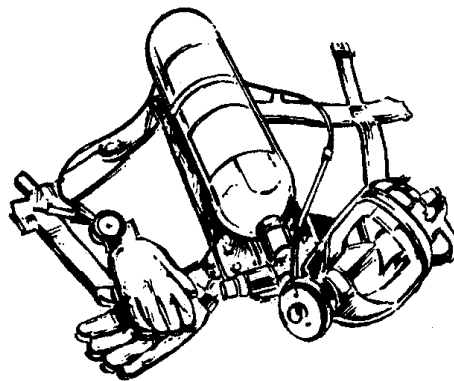
Securing mechanical moving parts

Personal Protective Equipment

When engineering controls cannot safely reduce or eliminate hazards, personal protective equipment must be used to protect your health and safety.

The type of protective equipment you will use depends on the hazards present and the tasks being performed.

Always make sure all personal protective equipment is in good working order and all clasps, belts, chains, and retrieval lines are working properly.



If you aren't sure what type of equipment you should be using, check the entry permit.

Attendant Duties

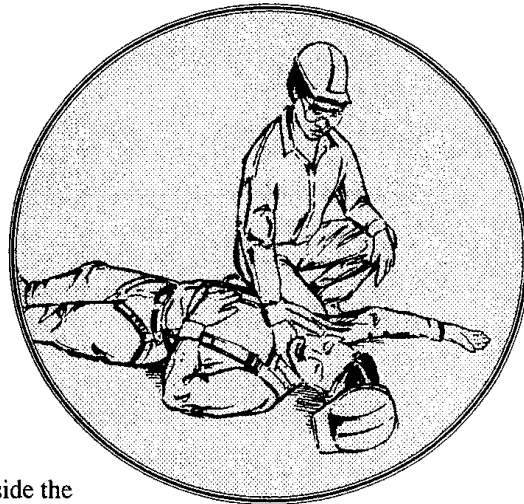
The attendant is the person stationed outside the permit space who monitors the authorized entrants inside and performs all the attendant's duties required in the permit space program. As an attendant, your responsibilities include:

- Know and be able to recognize the hazards that may be faced during entry.
- Be aware of possible effects of hazard exposure in authorized entrants.
- Keep track of all authorized entrants in the permit space and make sure the names of the authorized entrants listed on the entry permit accurately identify who is in the permit space.
- Remain stationed outside the permit space at all times during entry until you are relieved by another attendant.
- Communicate with authorized entrants to monitor their status and to alert entrants if they must evacuate the permit space.

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•Monitor inside and outside the space to determine if it is safe for entrants to remain in the space and order entrants to leave the permit space immediately for any of the following reasons:



- A prohibited condition is detected
- An authorized entrant shows symptoms of hazard exposure
- A situation is detected outside the space that could endanger authorized entrants
- The attendant cannot effectively and safely perform his or her duties.

•Summon emergency and rescue services when needed.

•When unauthorized persons approach or enter a permit space while entry is under way, take the following actions:

- Warn the unauthorized person that they must stay away from the permit space.
- If the unauthorized person has entered the permit space, advise him/her to exit immediately.
- Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

•Perform non-entry rescues

•Do not perform any duties that might interfere with your main duty to monitor and protect the authorized entrants.

Entry Supervisor Duties

As an entry supervisor, your duties would include determining if conditions are acceptable for entry into a permit space, authorizing entry, overseeing entry operations, and terminating entry when required. An entry supervisor may also serve as an attendant or an authorized entrant if he or she is trained and properly equipped for each role.

As an entry supervisor, your responsibilities are . . .

- Know the hazards that may be faced during entry.

- Verify that all tests specified by the permit have been conducted and that procedures and equipment specified by the permit are in place before authorizing entry.

- Terminate the entry and cancel the permit if required.

- Verify that rescue services are available and the means for summoning them are operable.

- Remove unauthorized persons who enter or attempt to enter the permit space during entry operations.

- Determine that entry operations are consistent with the terms of the entry permit and that acceptable entry conditions are maintained:

- when responsibility for a permit space entry operation is transferred;
- at intervals dictated by the hazards and operations performed in the space.



Contractor Procedures

When an employer hires a contractor to work in confined spaces, both the employer and contractor have certain responsibilities which help to ensure acceptable conditions while work is being carried out in the confined space.

Employer Responsibilities

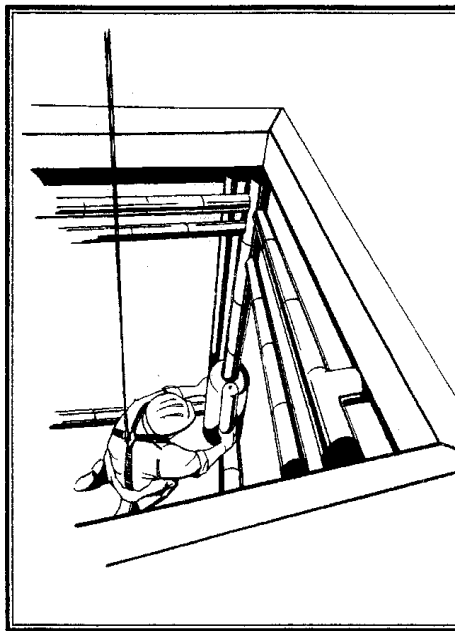
- Inform the contractor that the work place has permit spaces and that they must comply with a permit space program that meets the requirements of the standard.

- Tell the contractor why the space is a permit space. This includes notifying the contractor of the hazards identified and the host employer's experiences with the space.

- Inform the contractor of any special precautions or procedures used to protect employees who work in or near the permit space where contractor personnel will be working.

- Coordinate entry operations when employer and contractor personnel will be working in or near permit spaces.

- At the end of the job, conduct a debriefing session with the contractor to discuss the permit space program followed and hazards confronted or created during the entry.



Rescue Procedures

Your facility will either have an in-plant rescue team or arrangements for outside rescue services to respond when a confined space emergency occurs. If you are a member of your facility's in-plant rescue team, you need to be properly trained to handle confined space emergencies. Your employer will provide you with the proper training, equipment, and information you need to safely perform confined space rescues.

In-Plant

- You will be provided with rescue and personal protective equipment and the training necessary to use the equipment and perform rescues from permit spaces.
- Rescue team members will be trained to perform their assigned rescue duties. Each member must also receive the training required of authorized entrants.
- Rescue team members will practice making permit space rescues at least once every 12 months using simulated rescue operations.

• As a member of the rescue team, you must be trained in first-aid and in cardiopulmonary resuscitation (CPR). At least one member of the in-plant rescue team needs to be certified in basic first-aid and CPR.

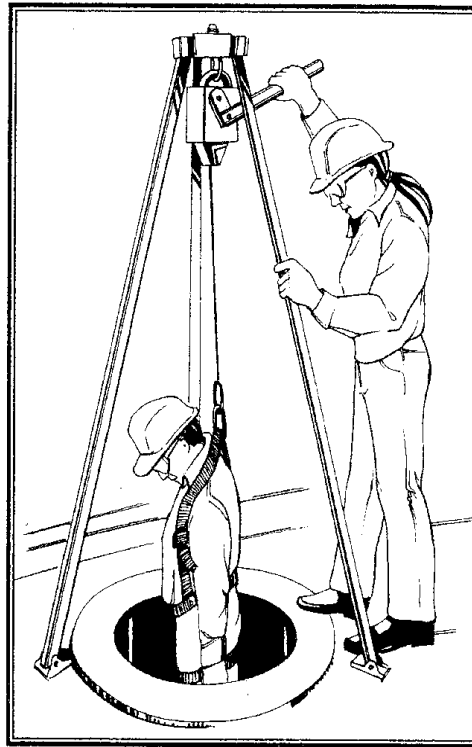


More than half of all deaths related to confined spaces happen when people rush in to attempt a rescue without properly preparing for the emergency. Unplanned rescues such as this can easily result in a double fatality or even multiple fatalities if there is more than one would-be rescuer. An in-plant rescuer should always be prepared before entering a confined space to help a co-worker.

Non-entry Rescue

If you need to perform a non-entry rescue from a permit space, use a retrieval system -- unless the retrieval equipment may increase the risk of entry or would not help in the rescue. The retrieval system includes a chest or full body harness with a retrieval line that is attached at the center of the person's back near shoulder level or above the head. The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space to help ensure a fast response.

Wristlets may be used instead of the harness if using the harness is not possible or is hazardous, and if the use of wristlets is the safest and most effective alternative.



To retrieve victims from a vertical permit space deeper than 5 feet, use a mechanical lifting device.

Review

1. Does your facility use an in-plant or outside rescue team?