Section 5
OSHA Confined Space Information
Confined Space Checklist

Safety and Health Topics:

Confined Spaces

Many workplaces contain spaces that are considered "confined" because their configurations hinder the activities of any employees who must enter, work in, and exit them. For example, employees who work in process vessels generally must squeeze in and out through narrow openings and perform their tasks while cramped or contorted. OSHA uses the term "confined space" to describe such spaces. In addition, there are many instances where employees who work in confined spaces face increased risk of exposure to serious hazards. In some cases, confinement itself poses entrapment hazards. In other cases, confined space work keeps employees closer to hazards, such as asphyxiating atmospheres or the moving parts of machinery. OSHA uses the term "permit-required confined space" (permit space) to describe those spaces that both meet the definition of "confined space" and pose health or safety hazards.

Related Safety and Health Topics

- Construction: Confined Spaces

Recognition

- Small Business Outreach Training Program Instructional Guide. OSHA Training Institute (1997). This document contains basic information about occupational safety and health, with specific focus on the needs of small business. It contains the following sections regarding Confined Spaces, and also provides discussion/overheads and student handouts:
  - Confined space hazards, overheads (1.91 MB PDF file), handouts (253 KB PDF file).
  - Permit-required confined space standard, overheads (1.59 MB PDF file), handouts (260 KB PDF file).
- Criteria for a Recommended Standard: Working in Confined Spaces. NIOSH (1979, December), 1 page. Table of contents to this document. The document is available as PDF files.
- Preventing Occupational Fatalities in Confined Spaces. NIOSH Alert (1986, January), 4 pages.
- Confined Space Entry Policy and Procedures Manual. St. Olaf College, 18 pages.
- Entering and Working in Confined Spaces. Oklahoma State University (1995, July 31), 1 page. Table of Contents to this Confined Spaces Manual.
- Confined Space Entry. Oregon State University's Safety Handbook, 91 KB PDF, 3 pages.
- Asphyxiation Hazard in Pits: Potential Confined Space Problem. OSHA Hazard Information Bulletin (1993, June 13), 1 page.
- Suffocation Hazards in Flat Storage Buildings and Tanks. OSHA Hazard Information Bulletin (1994, December 15), 1 page.
- Confined Space Hazards a Threat to Farmers. National Ag Safety Database (1992, May), 4 pages.
- Beware of Manure Pit Hazards. National Ag Safety Database (1993, May), 4 pages.
- Preventing Deaths of Farm Workers in Manure Pits. NIOSH Alert (1990, May), 4 pages.
- NIOSH Warns Farmers of Deadly Risk of Grain Suffocation. NIOSH Update (1993, April 28), 2 pages.
- Occupational Confined Space-Related Fatalities: Surveillance and Prevention. NIOSH Fatality Assessment and Control Evaluation (FACE) Project. The National Ag Safety Database provides a short (1 page) description of this project.
  - Two Men Die in Well Cleaning Operation–Maryland (1993), 4 pages.

    - Carbon Monoxide Kills Three Volunteer Firefighters Inside Well in Pennsylvania (1990), 4 pages.
    - Three Sanitation Workers and One Policeman Die in an Underground Pumping Station in Kentucky (1985), 1 page.

Evaluation

- Confined Spaces Advisor 1.1. OSHA (1997, December). This is interactive expert help for the Permit-Required Confined Spaces Standard (29 CFR 1910.146). It will assist users to identify confined spaces and deal with permit-required confined spaces. The program is available in both online and downloadable versions.
    - Online: Confined Spaces Advisor 1.1
    - Downloadable: Confined Spaces Advisor 1.1
- Permit-required Confined Space Decision Flow Chart. OSHA Regulation 1910.146 App A (1993, June), 2 pages.
- Procedures for Atmospheric Testing. OSHA Regulation 1910.146 App B.
- Air Testing Equipment. Department of Energy, Occupational Safety and Health Technical Reference (OTR), (1996, April), 2 pages.
- Confined-Space Reentry Checklist. Department of Energy, Occupational Safety and Health Technical Reference (OTR), (1996, April), 1 page.

Control

- OSHA Standards
    - 1910.146 App C, Examples of Permit-required Confined Space Programs
    - 1910.146 App D, Confined Space Pre-Entry Check List
    - 1910.146 App E, Sewer System Entry
    - Part 1915, Subpart B, App A, Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment.
- Confined-Space Entry. Department of Energy, Occupational Safety and Health Technical Reference (OTR), (1996, April). Table of Contents to this chapter. Contains elements of the DOE confined spaces program.
- Confined Space Entry. Department of Energy, Health and Safety Plan Guidelines. Contains guidelines on establishing a site-specific confined spaces program.
- Confined Space Entry Policy and Procedure. Sonoma State University, 6 pages. Example of a confined space entry program.
- Confined Space. National Institute for Environmental Health and Safety (1998, January 6), 9 pages. Example of a confined space entry program. Includes duties of individual jobs.
- Confined Space Management, Confined Space Rescue, Mark A. Brown, Rescue Net (1998), 3 pages. Provides an introduction to the topic of confined space rescues.
- OSHA Confined Space Entry Poster. National Ag Safety Database, 1 page. The poster is available as PDF files in 3 sizes.

Compliance

- Hugo Employers Fined for "Confined Space" Violations; Several Workers Injured. OSHA Regional News Release (2003, June). The alleged failure of three Hugo, Oklahoma, companies to train employees and give them adequate gear for working inside confined spaces with unsafe air has resulted in proposed penalties totaling $427,500 from the U.S. Department of Labor's Occupational Safety and Health Administration
- Compliance information, including Standards, Directives and Interpretations, is provided on a separate page.

Training

- Small Business Outreach Training Program Instructional Guide. OSHA Training Institute (1997). This guide contains basic information about selected topics in occupational safety and health. It is designed to provide ideas and organizational assistance to instructors who wish to present these topics, which specifically focus on the needs of small business. One section discusses confined space hazards, and another section discusses OSHA's permit-required confined space standard.
- Video Abstracts: Confined Space Entry. National Ag Safety Database provides references to several videos relating to confined space entry. These are available at minimal cost.

Other

- Construction: Confined Space Safety and Health Topics Page.
- Confined Space Entry. Oklahoma State University, 1 page. Links to a number of articles and information sheets relating to confined spaces.
- AIHA Confined Spaces Committee. The American Industrial Hygiene Association Confined Spaces Committee is a group of professionals from academia, general industry, consulting, enforcement, and maritime operations. All of the committee's collective knowledge and experience is available to any interested party through this page.

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PERMIT-REQUIRED CONFINED SPACES - 1910.146

Introduction

Requirements of the Standard

- General Requirements
- Written Program
- Permit System
- Entry Permits
- Training and Education
- Authorized Entrant's Duties
- Attendant's Duties
- Entry Supervisor's Duties
- Emergencies

References:

29 CFR 1910.0146: ***Permit-Required Confined Space***

Appendix A: ***Permit-Required Confined Space Decision Flow Chart***
Appendix B: ***Procedures for Atmospheric Testing***
Appendix C: ***Examples of Permit-Required Confined Space Program***
Appendix D: ***Confined Space Pre-Entry Check List***
Appendix E: ***Sewer System Entry***

Additional Sources of Information

Confined Spaces (OSHA Web Page)

Discussion/Overheads - 1.59 M

Student Handouts - 260 K

Self-Inspection Checklist

PERMIT-REQUIRED CONFINED SPACES - 1910.146

INTRODUCTION

Many workplaces contain spaces that are considered to be "confined" because their configurations hinder the activities of any employees who must enter into, work in, and exit from them. In many instances, employees who work in confined spaces also face increased risk of exposure to serious physical injury from hazards such as entrapment, engulfment, and hazardous atmospheric conditions. Confinement itself may pose entrapment hazards, and work in confined spaces may keep employees closer to hazards, such as an asphyxiating atmosphere, than they would be otherwise. For example, confinement, limited access, and restricted airflow can result in hazardous conditions that would not arise in an open workplace. The term "permit-required confined space" (i.e., permit space) refers to those spaces that meet the definition of a "confined space" and pose health or safety hazards, thereby requiring a permit for entry.

A **confined space** has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These

spaces may include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

A **permit-required confined space** is one that meets the definition of a confined space and has one or more of these characteristics: (1) contains or has the potential to contain a hazardous atmosphere, (2) contains a material that has the potential for engulfing an entrant, (3) has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section, and/or (4) contains any other recognized serious safety or health hazards.

REQUIREMENTS OF THE STANDARD General

In general, employers must evaluate the workplace to determine if spaces are permit-required confined spaces. (See flow chart). If there are permit spaces in the workplace, the employer must inform exposed employees of the existence, location, and danger posed by the spaces. This can be accomplished by posting danger signs or by another equally effective means. The following language would satisfy the requirements for such a sign:

DANGER--PERMIT REQUIRED-CONFINED SPACE--
AUTHORIZED ENTRANTS ONLY

If employees are not to enter and work in permit spaces, employers must take effective measures to prevent their employees from entering the permit spaces.

If employees are to enter permit spaces, the employer must develop a written permit space program, which shall be made available to employees or their representatives. Under certain conditions, the employer may use alternate procedures for worker entry into a permit space. For example, if employers can demonstrate with monitoring and inspection data that the only hazard is an actual or potential hazardous atmosphere, which can be made safe for entry by the use of continuous forced air ventilation alone, they may be exempted from some requirements, such as permits and attendants. Even in such circumstances, however, the internal atmosphere of the space must be tested first for oxygen content, second for flammable gases and vapors, and third for potential toxic air contaminants before any employee enters.

Written Program

The employer who allows employee entry must develop and implement a written program for permit-required confined spaces.

Among other things, the OSHA standard requires the employer's program to:

- Identify and evaluate permit space hazards before allowing employee entry;
- Test conditions in the permit space before entry operations and monitor the space during entry;
- Perform in the following sequence, appropriate testing for atmospheric hazards: oxygen, combustible gases or vapors, and toxic gases or vapors;
- Implement necessary measures to prevent unauthorized entry;
- Establish and implement the means, procedures and practices --such as specifying acceptable entry conditions, isolating the permit space, providing barriers, verifying acceptable entry conditions, purging, making inert, flushing, or ventilation of the permit space--to eliminate or control hazards necessary for safe permit-space entry operations;
- Identify employee job duties;
- Provide, maintain, and require, at no cost to the employee, the use of personal protective equipment and any other equipment necessary for safe entry (e.g., testing, monitoring, ventilating, communications, and lighting equipment; barriers, shields, and ladders);

- Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations;
- Coordinate entry operations when employees of more than one employer are to be working in the permit space;
- Implement appropriate procedures for summoning rescue and emergency services;
- Establish, in writing, and implement a system for the preparation, issuance, use, and cancellation of entry permits;
- Review established entry operations and annually revise the permit-space entry program; and
- When an attendant is required to monitor multiple spaces, implement the procedures to be followed during an emergency in one or more of the permit spaces being monitored.

If hazardous conditions are detected during entry, employees must immediately leave the space, and the employer must evaluate the space to determine the cause of the hazardous atmospheres.

When entry to permit spaces is prohibited, the employer must take effective measures to prevent unauthorized entry. Non-permit confined spaces must be reevaluated when there are changes in their use or configuration and, where appropriate, must be reclassified.

If testing and inspection data prove that a permit-required confined space no longer poses hazards, that space may be reclassified as a non-permit confined space. If entry is required to eliminate hazards and to obtain the data, the employer must follow procedures as set forth under sections (d) through (k) of the standard. A certificate documenting the data must be made available to employees entering the space. The certificate must include the date, location of the space, and the signature of the person making the certification.

Contractors also must be informed of permit spaces and permit space entry requirements, any identified hazards, the employer's experience with the space (i.e., the knowledge of hazardous conditions), and precautions or procedures to be followed when in or near permit spaces.

When employees of more than one employer are conducting entry operations, the affected employers must coordinate entry operations to ensure that affected employees are appropriately protected from permit space hazards. Contractors also must be given and other pertinent information regarding hazards and operations in permit spaces and be debriefed at the conclusion of entry operations.

Permit System

A permit, signed by the entry supervisor and verifying that pre-entry preparations have been completed and that the space is safe to enter, must be posted at entrances or otherwise made available to entrants before they enter a permit space.

The duration of entry permits must not exceed the time required to complete an assignment. Also, the entry supervisor must terminate entry and cancel permits when an assignment has been completed or when new conditions exist. New conditions must be noted on the canceled permit and used in revising the permit space program. The standard also requires the employer to keep all canceled entry permits for at least 1 year.

Entry Permits

Entry permits must include the following information:

- Test results;
- Tester's initials or signature;
- Name and signature of supervisor who authorizes entry;
- Name of permit space to be entered, authorized entrant(s), eligible attendants, and individual(s) authorized to be entry supervisor(s);

- Purpose of entry and known space hazards;
- Measures to be taken to isolate permit spaces and to eliminate or control space hazards, i.e., locking out or tagging of equipment and procedures for purging, making inert, ventilating and flushing permit spaces;
- Name and telephone numbers of rescue and emergency services;
- Date and authorized duration of entry;
- Acceptable entry conditions;
- Communication procedures and equipment to maintain contact during entry;
- Additional permits(s), such as for hot work, that have been issued to authorize work in the permit space;
- Special equipment and procedures, including personal protective equipment and alarm systems; and
- Any other information needed to ensure employee safety.

Training and Education

Before initial work assignment begins, the employer must provide proper training for all workers who are required to work in permit spaces. Upon completing this training, employers must ensure that employees have acquired the understanding, knowledge, and skills necessary for the safe performance of their duties. Additional training is required when (1) the job duties change, (2) there is a change in the permit-space program or the permit space operation presents a new hazard, and (3) when an employee's job performance shows deficiencies. Training also is required for rescue team members, including cardiopulmonary resuscitation (CPR) and first-aid training (see Emergencies). Employers must certify that training has been accomplished.

Upon completion of training, employees must receive a certificate of training that includes the employee's name, signature or initials of trainer(s), and dates of training. The certification must be made available for inspection by employees and their authorized representatives.

In addition, the employer also must ensure that employees are trained in their assigned duties.

Authorized Entrant's Duties

- Know space hazards, including information on the mode of exposure (e.g., inhalation or dermal absorption), signs or symptoms, and consequences of the exposure;
- Use appropriate personal protective equipment properly (e.g., face and eye protection, and other forms of barrier protection such as gloves, aprons, and coveralls);
- As necessary, maintain communication (i.e., telephone, radio, visual observation) with attendants to enable the attendant to monitor the entrant's status as well as to alert the entrant to evacuate;
- Exit from permit space as soon as possible when ordered by an authorized person, when the entrant recognizes the warning signs or symptoms of exposure exist, when a prohibited condition exists, or when an automatic alarm is activated; and
- Alert the attendant when a prohibited condition exists or when warning signs or symptoms of exposure exist.

Attendant's Duties

- Remain outside permit space during entry operations unless relieved by another authorized attendant;
- Perform no-entry rescues when specified by employer's rescue procedure;
- Know existing and potential hazards, including information on the mode of exposure, signs or symptoms, consequences of the exposure, and their physiological effects;
- Maintain communication with and keep an accurate account of those workers entering the permit-required space;

- Order evacuation of the permit space when a prohibited condition exists, when a worker shows signs of physiological effects of hazardous exposure, when an emergency outside the confined space exists, and when the attendant cannot effectively and safely perform required duties;
- Summon rescue and other services during an emergency;
- Ensure that unauthorized persons stay away from permit spaces or exit immediately if they have entered the permit space;
- Inform authorized entrant's and entry supervisor of entry by unauthorized persons; and;
- Perform no other duties that interfere with the attendant's primary duties.

Entry Supervisor's Duties

- Know space hazards including information on the mode of exposure, signs, or symptoms and consequences of exposure;
- Verify emergency plans and specified entry conditions such as permits, tests, procedures, and equipment before allowing entry;
- Terminate entry and cancel permits when entry operations are completed or if a new condition exists;
- Take appropriate measures to remove unauthorized entrants; and
- Ensure that entry operations remain consistent with the entry permit and that acceptable entry conditions are maintained.

Emergencies

The standard requires the employer to ensure that rescue service personnel are provided with and trained in the proper use of personal protective and rescue equipment, including respirators; trained to perform assigned rescue duties; and have had authorized entrant's training. The standard also requires that all rescuers be trained in first aid and CPR and, at a minimum, one rescue team member be currently certified in first aid and in CPR. The employer also must ensure that practice rescue exercises are performed yearly, and that rescue services are provided access to permit spaces so that they can practice rescue operations. Rescuers also must be informed of the hazards of the permit space.

Also, when appropriate, authorized entrants who enter a permit space must wear a chest or full body harness with a retrieval line attached to the center of their backs near shoulder level, or above their heads. Wristlets may be used if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard. Also, the employer must ensure that the other end of the retrieval line is attached to a mechanical device or to a fixed point outside the permit space. A mechanical device must be available to retrieve personnel from vertical type permit spaces more than 5 feet deep.

In addition, if an injured entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or other written information must be made available to the medical facility treating the exposed entrant.

Checklist of Considerations for Entry Working in and Exiting Confined Spaces

ITEM	CLASS A	CLASS B	CLASS C
1. Permit	x	x	x
2. Atmospheric Testing	x	x	x
3. Monitoring	x	o	o
4. Medical Surveillance	x	x	o
5. Training of Personnel	x	x	x
6. Labeling and Posting	x	x	x
7. Preparation			
Isolate/lockout/tag	x	x	o
Purge and ventilate	x	x	o
Cleaning processes	o	o	o
Requirements for special equipment/tools	x	x	o
8. Procedures			
Initial plan	x	x	x
Standby	x	x	o
Communications/observation	x	x	x
Rescue	x	x	x
Work	x	x	x
9. Safety Equipment and Clothing			
Head protection	o	o	o
Hearing protection	o	o	o
Hand protection	o	o	o
Foot protection	o	o	o
Body protection	o	o	o
Respiratory protection	o	o	o
Safety belts	x	x	x
Life lines/harness	x	o	o
10. Rescue Equipment	x	x	x
11. Record Keeping/Exposure	x	x	x

X = requirement
O = determination by the qualified person

How to Test

In order to have a safe work environment, the oxygen levels must be between 19.5 – 25%. It is necessary to test for toxic vapors BEFORE anyone goes into the confined space and before blowers are put into the area. Atmosphere testing in your confined space must be for:

1. Proper oxygen content
2. Presence of flammable or explosive substances
3. Presence of toxic gasses and/or vapors

The equipment should be checked out and tested prior to coming to the site.

Equipment needed:

- Warning sign
- Barricade or pylons
- Ventilating equipment
- Portable lighting
- Full face air-supplied respirator

- Life line and harness
- Mechanical lift devices
- Fire extinguisher
- Distress monitor
- Tyvek suits
- Gloves
- Boots

SOME of the common warning signals of an unsafe environment are:

- Shallow, rapid breathing
- Blurred vision
- Exaggerated sense of feeling good
- Disorientation
- Profuse sweating
- Ringing in ears
- Smell of solvent
- Slippery, sweet taste on the lips
- Dryness of throat
- Chest pains
- Change of heart rate
- Sudden skin irritation
- Loss of manual dexterity
- Loss of coordination
- Weakness in the knees

It should be stated that there must be a Confined Space Entry Team. There are duties and responsibilities of each member in the Confined Space Entry Team.

1. Pit Man: enters the confined space while attached to a rescue line.
2. Observer: responsible for pit man's safety and has a respirator nearby at all times.
3. 2nd Observer: summons help

OSHA requires a written rescue plan including:

- a list of all people at job site
- task each person is doing for the confined space entry
- each participant's duty in the event of rescue
- name and phone numbers for additional help
- maintained by 2nd Observer

Appendix C presents information that will help an employer conduct a training program on confined spaces.

Appendices

1. Appendix A: OSHA 29 CFR Part 1910, Permit Required Confined Spaces
2. Appendix B: State of Michigan Department of Labor Construction Safety Standards Commission, Safety Standards Part 90 Confined Space Entry
3. Appendix C: NIOSH Publication #80-106 (1979), Confined Space Personnel Training Considerations
4. Appendix D: Confined Space Entry Equipment Information
5. All appendices are for informational purposes only
6. Appendix D presents examples of personal protective equipment.

Confined Space Classification Table

Parameters	Class A	Class B	Class C
Characteristics	Immediately dangerous to life - rescue procedures require the entry of more than one individual fully equipped with life support equipment – maintenance of communication requires an additional standby person stationed within the confined space.	Dangerous, but not immediately life threatening – rescue procedures require the entry of no more than individual fully equipped with life support equipment – indirect visual or auditory communication with workers.	Potential hazard – requires no modification of work procedures – standard procedures – direct communication with workers, from outside confined space.
Oxygen	16% or less * (122 mm Hg) or greater than 25% * (190 mm Hg)	16.1% to 19.4% * (122 – 147 mm Hg) or 21.5% to 25% (163 – 190 mm Hg)	19.5% - 21.4% * (148 – 163 mm Hg)
Flammability Characteristics	20% or greater LFL	10% - 19% LFL	10% LFL or less
Toxicity	**IDLH	Greater than contamination level referenced in 29 CFR Part 1910 Sub Part Z – less than **IDLH	Less than contamination referenced in 29 CFR Part 1910 Sub Part Z

* = Based upon a total atmospheric pressure of 760 mm Hg (sea level)
** = Immediately dangerous to Life or Health – as referenced in HIOSH Registry of Toxic and Chemical Substance, Manufacturing Chemists data sheets, industrial hygiene guides or other recognized authorities.