



STREETER
ASSOCIATES

SHARP MINDS. SUPERIOR CONSTRUCTION.



CONFINED SPACE PROGRAM

TAB 5



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I.
Confined Space Policy



CONFINED SPACE POLICY

It is the policy of Streeter Associates, Inc. to re-classify Permit Required Confined Spaces to Non-Permit Required Confined Spaces according to OSHA Standards if possible.

If a confined space cannot be re-classified to Non-Permit Required the Corporate Safety Director, and Project Superintendent will collaborate and utilize the Confined Space OSHA Standard and implement a Confined Space Program to gain entry.

No employee shall enter a permit Required Confined Spaces without the knowledge and approval of the Corporate Safety Director, and Project Superintendent.

NO ENTRY IS TO BE MADE WITHOUT IMPLEMENTATION OF A CONFINED SPACE PROGRAM BY THE CORPORATE SAFETY DIRECTOR, AND PROJECT SUPERINTENDENT.

CONFINED SPACE DEFINITION AND CHARACTERISTICS

A confined space is defined as an enclosed space large enough for an employee to bodily enter and perform work, has limited or constricted means of entry & exit and is not designed for continuous occupancy.

A Permit Required Confined Space is a confined space having **one or more** of the following characters:

- Contains or has the potential to contain a hazardous atmosphere
- Contains material that has the potential for engulfment
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or areas which slope and taper to a smaller area
- Contains any other recognized serious safety or health hazard



II.
**Overview of OSHA's Construction Permit Required
Confined Space Standard**



1. OVERVIEW OF OSHA'S PERMIT REQUIRED CONFINED SPACE STANDARD

On January 14, 1993, OSHA issued the long awaited "Permit Required Confined Spaces Standard" (29 CFR 1910.146) which has been 17 years in development. On May 1, 2015, OSHA issued its long-awaited "confined space in construction" standard. This standard establishes safety requirements for entry into confined spaces on construction sites. Many employers already have comprehensive programs to protect their employees from the toxic, explosive, and mechanical hazards found in confined spaces. However, many workers remain ignorant of the risks involved in entering an untested confined space. The hazards encountered in entering confined spaces have resulted in worker injuries, deaths, and property damage. Most accidents associated with confined spaces occur because of the lack of knowledge or ignoring the hazards.

The configuration of a confined space hinders the activities of any employees who must enter, work in and exit that space. The OSHA standard defines such a space as one which is large enough for an employee to enter and perform work, has limited or restricted means of entry and is not designed for continuous employee occupancy.

OSHA also defines a permit required confined space (permit space) as a confined space that has one or more of the following characteristics: contains or has the potential to contain a hazardous atmosphere; contains material that has the potential to engulf the entrant; has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a small cross section; and/or contains any other recognized serious safety or health hazard.

This new Permit Required Confined Space (PRCS) definition is based on OSHA's investigation into confined space fatalities. The standard addresses the hazards which have resulted in serious injuries and fatalities. OSHA's investigations of fatalities have shown that employees have not appreciated the hazardous conditions of confined space work.



Confined Space Highlights

Scope

(a) This standard sets forth requirements for practices and procedures to protect employees engaged in construction activities at a worksite with one or more confined spaces, subject to the exceptions in paragraph (b) of this section. Note to paragraph §1926.1201(a). Examples of locations where confined spaces may occur include, but are not limited to, the following: Bins; boilers; pits (such as elevator, escalator, pump, valve or other equipment); manholes (such as sewer, storm drain, electrical, communication, or other utility); tanks (such as fuel, chemical, water, or other liquid, solid or gas); incinerators; scrubbers; concrete pier columns; sewers; transformer vaults; heating, ventilation, and air- conditioning (HVAC) ducts; storm drains; water mains; 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; and/or mixers/reactors.

(b) **Exceptions.** This standard does not apply to: (1) Construction work regulated by

§1926 subpart P—Excavations. (2) Construction work regulated by §1926 subpart S—Underground Construction, Caissons, Cofferdams and Compressed Air. (3) Construction work regulated by §1926 subpart Y—Diving.

(c) Where this standard applies and there is a provision that addresses a confined space hazard in another applicable OSHA standard, the employer must comply with both that requirement and the applicable provisions of this standard.

General requirements

Defined as an area which has an adequate size and configuration for employee entry, has limited means of access or egress, and is not designed for continuous employee occupancy.

Permit Required Confined Space

Is a confined space that represents or has the potential for hazards relating to atmospheric conditions (toxic, flammable, asphyxiating) engulfment, configuration or any other recognized serious hazard.

Prohibited Condition

Defined as any activity/condition not allowed by the permit during entry operations.



Evaluation

Requires employers to evaluate their work places and determine if there are any permit required confined spaces present. Employees are to be informed by danger signs or other equally effective means. Unauthorized entry must be prevented.

Permit Required Confined Space Program

Mandates a written program to prevent unauthorized entry, identify and evaluate hazards, and establish procedures and practices for safe entry including testing and monitoring conditions. Calls for an attendant stationed outside permit spaces during entry. Procedures to summon rescue, prevent unauthorized personnel from attempting rescues, and a system for preparing, issuing, using, and canceling entry permits. Requires coordinated entry for more than one employer, procedures for concluding entry operations and canceling entry permits, and review of permit program at least annually.

Permit System

Requires an entry supervisor to authorize entry, prepare and sign written permits, order corrective measures, if necessary, and cancel permits when works completed. Permits must be available to all employees and last only for duration of the task. They must be retained for a year to facilitate review of the confined space program.

Permits

Must include identification of the space, purpose of entry, date and duration of permit, list of authorized entrants, names of current attendants and entry supervisors, list of hazards in the permit space, and list the measures to isolate permit space and eliminate/control hazards. Permits must also state the acceptable entry conditions, results of entry tests initialed by the persons performing the tasks, rescue and emergency procedures, a means to summon and communicate, communication procedures for attendants/entrants, required equipment (such as respirators, retrieval systems, etc.), any other necessary information, and additional permits such as hot work.

Training

Mandates initial and refresher (when duties change, hazards of the space change, whenever an evaluation identifies inadequacies in employee's knowledge) training to provide employees with understanding, skills, and knowledge to do job safely. Employer certification of training must include employee's name, signature or initials of trainer and date of training.



Authorized Entrants

Must know the hazards they may face, be able to recognize signs or symptoms of exposure, and understand the consequences of exposure to hazards. Entrants must know how to use any needed equipment, communicate with attendants as necessary, and alert attendants when a warning symptom or other hazardous condition exists. Entrants must exit as quickly as possible whenever ordered or alerted by alarm, warning sign or prohibitive condition.

Attendants

Must know hazards of the confined space, be aware of behavioral effects of potential exposures, maintain continuous count of authorized entrants, remain outside space until relieved, and communicate with entrants as necessary to monitor entrant status. Attendants also must monitor activities inside and outside the permit space, order exit of the space if required, summon rescuers if necessary, prevent unauthorized entry into confined spaces, and perform non-entry rescues if possible. They may not perform other duties that interfere with their primary duty to monitor the space and prevent entry by unauthorized personnel.

Entry Supervisors

Must know hazards of confined spaces, verify that all tests have been conducted and all procedures and equipment are in place before endorsing permit. Terminate entry, cancel permits, verify that rescue services are available and the means for summoning them is operable. Supervisors are to remove unauthorized individuals who enter confined space. When shifts and entry supervisors change, the next entry supervisor must determine that acceptable conditions continue as specified in permit.

Rescue Services

A Confined Space Rescue Team must be at the space or on standby for Permit Required Confined Spaces that have the potential for entrapment or engulfment, or spaces where you'd be unable to safely remove an entrant should they become unconscious. Standby rescue teams must be close enough to respond in a timely manner. This is generally understood to be less than a five minute response time or standing by at the space for more challenging rescue scenarios. On site teams must be properly equipped. Rescuers are to use employee retrieval systems whenever possible. They must receive the same training as authorized entrants, plus training to use personal protective equipment and rescue equipment and first aid training including CPR. They must practice simulated rescues at least once every 12 months.

Outside rescue services must be made aware of hazards, receive access to comparable permit spaces to develop rescue plans, and practice rescues. Employer must provide hospitals or treatment facilities, with SDSs or other information about the hazards of the permit space that may aid in treatment of rescued employees.



Contractors

Calls for host employers to provide information on permit spaces to contractors, the permit space program procedures, and the hazards that the contractor is likely to encounter. Joint entries must be coordinated and the contractors debriefed at the conclusion of entry operations.

Alternative Protection Procedures

For permit spaces where the only hazard is atmospheric and ventilation alone can control the hazard, employers may use alternative procedures for entry. To qualify for alternative procedures, employees must:

1. Ensure that it is safe to remove the entrance cover;
2. Determine if ventilation alone is sufficient to maintain the permit space safe for entry;
3. Ensure that work to be performed within the permit required space introduces no additional hazards;
4. Gather monitoring inspection data to support 1, 2, & 3;
5. If entry is necessary to conduct initial data gathering, perform such entries under the full permit program; and
6. Document the determination of the supporting evidence and make it available to employees.

Entry can take place after it has been determined that it is safe to remove the entrance cover; openings are guarded to protect against falling and falling objects; internal atmosphere testing is conducted; air remains non-hazardous whenever any employee is inside the space; continuous forced air ventilation has eliminated any hazardous atmosphere; and the space is tested periodically. Employees must exit immediately if a hazardous atmosphere is detected during entry and the space must be evaluated to determine how the hazardous atmosphere developed.



Overview of OSHA's Confined Space General Requirements



General Requirements

Before work begins at a worksite, each employer must ensure that a competent person identifies all confined spaces in which one or more of the employees it directs may work, and identifies each space that is a permit space, through consideration and evaluation of the elements of that space, including testing as necessary.

If the workplace contains one or more permit spaces, the employer who identifies, or who receives notice of a permit space must:

- Inform exposed employees by posting danger signs or by any other equally effective means, of the existence and location of, and the danger posed by, each permit space; and

Note: A sign reading "DANGER-PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign.

- Inform, in a timely manner and in a manner other than posting, its employees' authorized representatives and the controlling contractor of the existence and location of, and the danger posed by each permit space.

Each employer who identifies, or receives notice of, a permit space and has not authorized employees it directs to work in that space must take effective measures to prevent those employees from entering that permit space, in addition to complying with all other applicable requirements of the Confined Space standard.

If any employer decides that employees it directs will enter a permit space, that employer must have a written permit space program implemented at the construction site. The written program must be made available prior to and during entry operations for inspection by employees and their authorized representatives.

An employer may use the alternate procedures specified in paragraph (2) of this section for entering a permit space only under the conditions set forth in paragraph (1) of this section

1. An employer whose employees enter a permit space need not comply with OSHA standards 1926.1204 through 1926.1206 and 1926.1208 through 1926.1211 provided that the following conditions are met:
 - A. The employer can demonstrate that all physical hazards in the space are eliminated or isolated through engineering controls so that the only hazard posed by the permit space is an actual or potential hazardous atmosphere;



- B. The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry, and that, in the event the ventilation system stops working, entrants can exit the space safely
- C. The employer develops monitoring and inspection data that supports the demonstrations required by (I)(A) and (I)(B) of this section;
- D. If an initial entry of the permit space is necessary to obtain the data required by paragraph (I)(C) of this section, the entry is performed in compliance with Permit-required Entry requirements
- E. The determinations and supporting data required by paragraphs (I)(A), (I)(B), and (I)(C) of this section are documented by the employer and are made available to each employee who enters the permit space under the terms of paragraph of this section or to that employee's authorized representative and
- F. Entry into the permit space under the terms of paragraph (I) of this section is performed in accordance with the requirements of paragraph (4) of this section.

Note to paragraph (I). See paragraph (4) of this section for reclassification of a permit space after all hazards within the space have been eliminated.

- 2. The following requirements apply to entry into permit spaces that meet the conditions set forth in paragraph (I) of this section:
 - A. Any conditions making it unsafe to remove an entrance cover must be eliminated before the cover is removed.
 - B. When entrance covers are removed, the opening must be immediately guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.
 - C. Before an employee enters the space, the internal atmosphere must be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any employee, who enters the space, or that employee's authorized representative, must be provided an opportunity to observe the pre-entry testing required by this paragraph.
 - D. No hazardous atmosphere is permitted within the space whenever any employee is inside the space.
 - E. Continuous forced air ventilation must be used, as follows:
 - a. An employee must not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;



- b. The forced air ventilation must be so directed as to ventilate the immediate areas where an employee is or will be present within the space and must continue until all employees have left the space;
 - c. The air supply for the forced air ventilation must be from a clean source and must not increase the hazards in the space
 - F. The atmosphere within the space must be continuously monitored unless the entry employer can demonstrate that equipment for continuous monitoring is not commercially available or periodic monitoring is sufficient. If continuous monitoring is used, the employer must ensure that the monitoring equipment has an alarm that will notify all entrants if a specified atmospheric threshold is achieved, or that an employee will check the monitor with sufficient frequency to ensure that entrants have adequate time to escape. If continuous monitoring is not used, periodic monitoring is required. All monitoring must ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere. Any employee who enters the space, or that employee's authorized representative, must be provided with an opportunity to observe the testing required by this paragraph
 - G. If a hazard is detected during entry:
 - a. Each employee must leave the space immediately;
 - b. The space must be evaluated to determine how the hazard developed; and
 - c. The employer must implement measures to protect employees from the hazard before any subsequent entry takes place.
 - H. The employer must ensure a safe method of entering and exiting the space. If a hoisting system is used, it must be designed and manufactured for personnel hoisting; however, a job-made hoisting system is permissible if it is approved for personnel hoisting by a registered professional engineer, in writing, prior to use.
 - I. The employer must verify that the space is safe for entry and that the pre-entry measures required by paragraph (2) of this section have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification must be made before entry and must be made available to each employee entering the space or to that employee's authorized representative.
- 3. When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, or some indication that the initial evaluation of the space may not have been adequate, each entry employer must have a competent person reevaluate that space and, if necessary, reclassify it as a permit-required confined space.



4. A space classified by an employer as a permit-required confined space may only be reclassified as a non-permit confined space when a competent person determines that all of the applicable requirements in paragraphs (4)(A) through (D) of this section have been met:
 - A. If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated or isolated without entry into the space (unless the employer can demonstrate that doing so without entry is infeasible), the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated or isolated;
 - B. The entry employer must eliminate or isolate the hazards without entering the space, unless it can demonstrate that this is infeasible. If it is necessary to enter the permit space to eliminate or isolate hazards, such entry must be performed under 1926.1204 through 1926.1211 of the OSHA standards. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated or isolated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated or isolated;

Note to paragraph (4)(B). Control of atmospheric hazards through forced air ventilation does not constitute elimination or isolation of the hazards. Paragraph (I) of this section covers permit space entry where the employer can demonstrate that forced air ventilation alone will control all hazards in the space.

- C. The entry employer must document the basis for determining that all hazards in a permit space have been eliminated or isolated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification must be made available to each employee entering the space or to that employee's authorized representative; and
- D. If hazards arise within a permit space that has been reclassified as a non-permit space under paragraph (4) of this section, each employee in the space must exit the space. The entry employer must then reevaluate the space and reclassify it as a permit space as appropriate in accordance with all other applicable provisions of this standard.



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Permit Space Entry Communication and coordination



Permit space entry communication and coordination.

I. Before entry operations begin, the host employer must provide the following information, if it has it, to the controlling contractor:

- The location of each known permit space;
- The hazards or potential hazards in each space or the reason it is a permit space and
- Any precautions that the host employer or any previous controlling contractor or entry employer implemented for the protection of employees in the permit space.

Before entry operations begin, the controlling contractor must:

- Obtain the host employer's information about the permit space hazards and previous entry operations and
- Provide the following information to each entity entering a permit space and any other entity at the worksite whose activities could foreseeably result in a hazard in the permit space:
 - The information received from the host employer;
 - Any additional information the controlling contractor has about the subjects listed in paragraph (I) of this section; and
 - The precautions that the host employer, controlling contractor, or other entry employers implemented for the protection of employees in the permit spaces.

Before entry operations begin, each entry employer must:

- Obtain all of the controlling contractor's information regarding permit space hazards and entry operations; and
- Inform the controlling contractor of the permit space program that the entry employer will follow, including any hazards likely to be confronted or created in each permit space.

The controlling contractor and entry employer(s) must coordinate entry operations when:

- More than one entity performs permit space entry at the same time; or



- Permit space entry is performed at the same time that any activities that could foreseeably result in a hazard in the permit space are performed.

After entry operations:

- The controlling contractor must debrief each entity that entered a permit space regarding the permit space program followed and any hazards confronted or created in the permit space(s) during entry operations;
- The entry employer must inform the controlling contractor in a timely manner of the permit space program followed and of any hazards confronted or created in the permit space(s) during entry operations; and
- The controlling contractor must apprise the host employer of the information exchanged with the entry entities pursuant to this subparagraph.

Note to paragraph (I) of this section. Unless a host employer or controlling contractor has or will have employees in a confined space, it is not required to enter any confined space to collect the information specified in this paragraph (I).

- If there is no controlling contractor present at the worksite, the requirements for, and role of, controlling contractors in this section must be fulfilled by the host employer or other employer who arranges to have employees of another employer perform work that involves permit space entry.



Permit-Required Confined Space Program



Permit-Required Confined Space program

Each entry employer must:

- Implement the measures necessary to prevent unauthorized entry;
- Identify and evaluate the hazards of permit spaces before employees enter them;
- Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:
 - Specifying acceptable entry conditions;
 - Providing each authorized entrant or that employee's authorized representative with the opportunity to observe any monitoring or testing of permit spaces;
 - Isolating the permit space and physical hazard(s) within the space;
 - Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;

Note. When an employer is unable to reduce the atmosphere below 10 percent LFL, the employer may only enter if the employer inertes the space so as to render the entire atmosphere in the space non-combustible, and the employees use PPE to address any other atmospheric hazards (such as oxygen deficiency), and the employer eliminates or isolates all physical hazards in the space.

- Determining that, in the event the ventilation system stops working, the monitoring procedures will detect an increase in atmospheric hazard levels in sufficient time for the entrants to safely exit the permit space;
 - Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards;
 - Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry, and ensuring that employees are not allowed to enter into, or remain in, a permit space with a hazardous atmosphere unless the employer can demonstrate that personal protective equipment (PPE) will provide effective protection for each employee in the permit space and provides the appropriate PPE to each employee; and
 - Eliminating any conditions (for example, high pressure) that could make it unsafe to remove an entrance cover.
- Provide the following equipment at no cost to each employee, maintain that equipment properly, and ensure that each employee uses that equipment properly:



- Testing and monitoring equipment needed to comply with the OSHA standards
 - Ventilating equipment needed to obtain acceptable entry conditions;
 - Communications equipment necessary for compliance with §§ 1926.1208(c) and 1926.1209(e), including any necessary electronic communication equipment for attendants assessing entrants' status in multiple spaces;
 - Personal protective equipment insofar as feasible engineering and work-practice controls do not adequately protect employees;
 - Lighting equipment that meets the minimum illumination requirements in § 1926.56, that is approved for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present, and that is sufficient to enable employees to see well enough to work safely and to exit the space quickly in an emergency;
 - Barriers and shields as required by this section;
 - Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;
 - Rescue and emergency equipment needed to comply with this section, except to the extent that the equipment is provided by rescue services; and
 - Any other equipment necessary for safe entry into, safe exit from, and rescue from, permit spaces.
- Evaluate permit space conditions in accordance with this section when entry operations are conducted:
- Test conditions in the permit space to determine if acceptable entry conditions exist before changes to the space's natural ventilation are made, and before entry is authorized to begin, except that, if an employer demonstrates that isolation of the space is infeasible because the space is large or is part of a continuous system (such as a sewer), the employer must:
 - Perform pre-entry testing to the extent feasible before entry is authorized; and,
 - If entry is authorized, continuously monitor entry conditions in the areas where authorized entrants are working, except that employers may use periodic monitoring in accordance with paragraph (e)(2) of this section for monitoring an atmospheric hazard if they can demonstrate that equipment for continuously monitoring that hazard is not commercially available;



- Provide an early-warning system that continuously monitors for non-isolated engulfment hazards. The system must alert authorized entrants and attendants in sufficient time for the authorized entrants to safely exit the space.
- Continuously monitor atmospheric hazards unless the employer can demonstrate that the equipment for continuously monitoring a hazard is not commercially available or that periodic monitoring is of sufficient frequency to ensure that the atmospheric hazard is being controlled at safe levels. If continuous monitoring is not used, periodic monitoring is required with sufficient frequency to ensure that acceptable entry conditions are being maintained during the course of entry operations;
- When testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors;
- Provide each authorized entrant or that employee's authorized representative an opportunity to observe the pre-entry and any subsequent testing or monitoring of permit spaces;
- Reevaluate the permit space in the presence of any authorized entrant or that employee's authorized representative who requests that the employer conduct such reevaluation because there is some indication that the evaluation of that space may not have been adequate; and
- Immediately provide each authorized entrant or that employee's authorized representative with the results of any testing conducted in accordance with this section.
- Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations:
 - Attendants may be assigned to more than one permit space provided the duties described in this program can be effectively performed for each permit space.
 - Attendants may be stationed at any location outside the permit space as long as the duties described in 1926.1209 can be effectively performed for each permit space to which the attendant is assigned.
- If multiple spaces are to be assigned to a single attendant, include in the permit program the means and procedures to enable the attendant to respond to an emergency affecting one or more of those permit spaces without distraction from the attendant's responsibilities under § 1926.1209;
- Designate each person who is to have an active role (as, for example, authorized entrants, attendants, entry supervisors, or persons who test or monitor the atmosphere in a permit



space) in entry operations, identify the duties of each such employee, and provide each such employee with the training required by § 1926.1207;

- Develop and implement procedures for summoning rescue and emergency services (including procedures for summoning emergency assistance in the event of a failed non- entry rescue), for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized personnel from attempting a rescue;
- Develop and implement a system for the preparation, issuance, use, and cancellation of entry permits as required by this standard, including the safe termination of entry operations under both planned and emergency conditions;
- Develop and implement procedures to coordinate entry operations, in consultation with the controlling contractor, when employees of more than one employer are working simultaneously in a permit space or elsewhere on the worksite where their activities could, either alone or in conjunction with the activities within a permit space, foreseeably result in a hazard within the confined space, so that employees of one employer do not endanger the employees of any other employer;
- Develop and implement procedures (such as closing off a permit space and canceling the permit) necessary for concluding the entry after entry operations have been completed;
- Review entry operations when the measures taken under the permit space program may not protect employees and revise the program to correct deficiencies found to exist before subsequent entries are authorized; and

Note to paragraph (m). *Examples of circumstances requiring the review of the permit space program include, but are not limited to: Any unauthorized entry of a permit space, the detection of a permit space hazard not covered by the permit, the detection of a condition prohibited by the permit, the occurrence of an injury or near-miss during entry, a change in the use or configuration of a permit space, and employee complaints about the effectiveness of the program.*

- Review the permit space program, using the canceled permits retained under § 1926.1205(f), within 1 year after each entry and revise the program as necessary to ensure that employees participating in entry operations are protected from permit space hazards.

Note to paragraph (n). *Employers may perform a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review is necessary.*



Permitting Process



Permitting Process

Before entry is authorized, each entry employer must document the completion of measures required by § 1926.1204(c) by preparing an entry permit.

Before entry begins, the entry supervisor identified on the permit must sign the entry permit to authorize entry.

The completed permit must be made available at the time of entry to all authorized entrants or their authorized representatives, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit in accordance with § 1926.1206(b).

The entry supervisor must terminate entry and take the following action when any of the following apply:

- Cancel the entry permit when the entry operations covered by the entry permit have been completed; or
- Suspend or cancel the entry permit and fully reassess the space before allowing reentry when a condition that is not allowed under the entry permit arises in or near the permit space and that condition is temporary in nature and does not change the configuration of the space or create any new hazards within it; and
- Cancel the entry permit when a condition that is not allowed under the entry permit arises in or near the permit space

The entry employer must retain each canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program required by § 1926.1204(n). Any problems encountered during an entry operation must be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.



Entry Permit



Entry Permit

The entry permit that documents compliance with this section and authorizes entry to a permit space must identify:

- The permit space to be entered;
- The purpose of the entry;
- The date and the authorized duration of the entry permit;
- The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

Note to paragraph (d). *This requirement may be met by inserting a reference on the entry permit as to the means used, such as a roster or tracking system, to keep track of the authorized entrants within the permit space.*

- Means of detecting an increase in atmospheric hazard levels in the event the ventilation system stops working;
- Each person, by name, currently serving as an attendant;
- The individual, by name, currently serving as entry supervisor, and the signature or initials of each entry supervisor who authorizes entry;
- The hazards of the permit space to be entered;
- The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;

Note. *Those measures can include, but are not limited to, the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.*

- The acceptable entry conditions;
- The results of tests and monitoring performed under § 1926.1204(e), accompanied by the names or initials of the testers and by an indication of when the tests were performed;



- The results of tests and monitoring performed under § 1926.1204(e), accompanied by the names or initials of the testers and by an indication of when the tests were performed;
- The rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;
- The communication procedures used by authorized entrants and attendants to maintain contact during the entry;
- Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this standard;
- Any other information necessary, given the circumstances of the particular confined space, to ensure employee safety; and
- Any additional permits, such as for hot work, that have been issued to authorize work in the permit space.



Training



2. TRAINING

Many confined space injuries and fatalities can be attributed to inadequate training. Therefore, training is required by the standard for entrants, attendants, entry supervisors and for rescue team members. OSHA specifies that prior to any confined space entry every employee must be trained so they acquire the understanding, knowledge and skills necessary for the safe performance of their duties.

Employee training must be provided to each affected employee:

- In both a language and vocabulary that the employee can understand
- Before the employee is first assigned duties under this standard
- Before there is a change in assigned duties
- Whenever there is a change in permit space entry operations that presents a hazard about which an employee has not previously been trained
- Whenever there is any evidence of a deviation from the permit space entry procedures or there are inadequacies in the employee's knowledge or use of these procedures.

The OSHA standard requires employees to demonstrate proficiency through the use of equipment, or by passing a test. Written as well as practical field testing is recommended. Personnel should be questioned or asked to demonstrate their practical knowledge of confined space hazards that are in their work areas.

The employer must also certify the training. Certification must contain the employee's name, the signature of the trainer, and the dates of training. The certification must be available for inspection by employees and their authorized representatives for the period of time the employee is employed by that employer.

Duties of authorized entrants

The entry employer must ensure that all authorized entrants:

- Are familiar with and understand the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
- Properly use equipment as required per OSHA standards
- Communicate with the attendant as necessary to enable the attendant to assess entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required



- Alert the attendant whenever:
 - There is any warning sign or symptom of exposure to a dangerous situation; or
 - The entrant detects a prohibited condition; and
- Exit from the permit space as quickly as possible whenever:
 - An order to evacuate is given by the attendant or the entry supervisor;
 - There is any warning sign or symptom of exposure to a dangerous situation;
 - The entrant detects a prohibited condition; or
 - An evacuation alarm is activated.

Duties of attendants

The entry employer must ensure that each attendant:

- Is familiar with and understands the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
- Is aware of possible behavioral effects of hazard exposure in authorized entrants
- Continuously maintains an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants accurately identifies who is in the permit space
- Remains outside the permit space during entry operations until relieved by another attendant

Note- Once an attendant has been relieved by another attendant, the relieved attendant may enter a permit space to attempt a rescue when the employer's permit space program allows attendant entry for rescue and the attendant has been trained and equipped for rescue operations as required by the OSHA standards.

- Communicates with authorized entrants as necessary to assess entrant status and to alert entrants of the need to evacuate the space under paragraph §1926.1208(e);
- Assesses activities and conditions inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:
 - If there is a prohibited condition
 - If the behavioral effects of hazard exposure are apparent in an authorized entrant
 - If there is a situation outside the space that could endanger the authorized entrants
or
 - If the attendant cannot effectively and safely perform all the duties required Under §1926.1209



- Summons rescue and other that authorized entrants may need assistance to escape from permit space hazards
- Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:
 - Warns the unauthorized persons that they must stay away from the permit space
 - Advises the unauthorized persons that they must exit immediately if they have entered the permit space and
 - Informs the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space
- Performs non-entry rescues as specified by the employer's rescue procedure
- Performs no duties that might interfere with the attendant's primary duty to assess and protect the authorized entrants.

Duties of entry Supervisors

The entry employer must ensure that each entry supervisor:

- Is familiar with and understands the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
- Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin
- Terminates the entry and cancels or suspends the permit as required per OSHA
- Verifies that rescue services are available and that the means for summoning them
- Are operable, and that the employer will be notified as soon as the services become unavailable
- Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations and
- Determines, whenever responsibility for a permit space entry operation is transferred, and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

Rescue and emergency services

An employer who designates rescue and emergency services must:

- Evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified



Note- what will be considered timely will vary according to the specific hazards involved in each entry. For example, §1926.103—Respiratory Protection requires that employers provide a standby person or persons capable of immediate action to rescue employee(s) wearing respiratory protection while in work areas defined as IDLH atmospheres.

- Evaluate a prospective rescue service’s ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit space or types of permit spaces identified
- Select a rescue team or service from those evaluated that:
 - Has the capability to reach the victim(s) within a time frame that is appropriate for the permit space hazard(s) identified
 - Is equipped for, and proficient in, performing the needed rescue services Agrees to notify the employer immediately in the event that the rescue service becomes unavailable
- Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site and
- Provide the rescue team or service selected with access to all permit spaces from which rescue may be necessary so that the rescue team or service can develop appropriate rescue plans and practice rescue operations.
- An employer whose employees have been designated to provide permit space rescue and/or emergency services must take the following measures and provide all equipment and training at no cost to those employees:
 - Provide each affected employee with the personal protective equipment (PPE) needed to conduct permit space rescues safely and train each affected employee so the employee is proficient in the use of that PPE
 - Train each affected employee to perform assigned rescue duties. The employer must ensure that such employees successfully complete the training required and establish proficiency as authorized entrants, as provided by §§1926.1207 and 1926.1208
 - Train each affected employee in basic first aid and cardiopulmonary resuscitation (CPR). The employer must ensure that at least one member of the rescue team or service holding a current certification in basic first aid and CPR is available and
 - Ensure that affected employees practice making permit space rescues before attempting an actual rescue, and at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces, except



practice rescue is not required where the affected employees properly performed a rescue operation during the last 12 months in the same permit space the authorized entrant will enter, or in a similar permit space. Representative permit spaces must, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

- Non-entry rescue is required unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. The employer must designate an entry rescue service whenever non-entry rescue is not selected. Whenever non-entry rescue is selected, the entry employer must ensure that retrieval systems or methods are used whenever an authorized entrant enters a permit space, and must confirm, prior to entry, that emergency assistance would be available in the event that non-entry rescue fails. Retrieval systems must meet the following requirements:
 - Each authorized entrant must use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, or at another point which the employer can establish presents a profile small enough for the successful removal of the entrant. Wristlets or anklets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets or anklets is the safest and most effective alternative.
 - The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device must be available to retrieve personnel from vertical type permit spaces more than 5 feet (1.52 meters) deep.
 - Equipment that is unsuitable for retrieval must not be used, including, but not limited to, retrieval lines that have a reasonable probability of becoming entangled with the retrieval lines used by other authorized entrants, or retrieval lines that will not work due to the internal configuration of the permit space.
- If an injured entrant is exposed to a substance for which a Safety Data Sheet (SDS) or other similar written information is required to be kept at the worksite, that SDS or written information must be made available to the medical facility treating the exposed entrant.



IV.

Confined Space Hazards



CONFINED SPACE HAZARDS

There are many different types of hazards which can be encountered in a confined space. The purpose of a PRCS program is to address and identify the hazards and to provide a method of protecting employees by controlling these hazards. The more familiar your organization becomes in recognizing confined spaces and the hazards associated with them, the less likely it will be to fall victim to them. The major hazards potentially encountered in confined spaces include: atmospheric hazards, engulfment, and mechanical hazards. A NIOSH study of 88 confined space fatalities lists how workers have died in confined spaces:

- asphyxiation 47%,
- drowning 23%,
- exposure to toxic chemicals 19%,
- blunt force trauma 10%,
- electrocution 2%, and
- burns 1%

If you include asphyxiation, drowning* and exposure to toxic chemicals as all being attributed to a hazardous atmosphere, then it can be concluded that the vast majority of fatalities are associated with atmospheric hazards. You may also encounter physical, electrical, biological, corrosive as well as other hazards in confined spaces.

Preplanning confined space entries includes identification and evaluation of potential hazards. The hazard identification process includes a review of the previous and current uses of the space which can adversely affect the atmosphere therein. This can be done by reviewing safety data sheets (SDS) of the materials stored in the tank and the chemicals which will be used in the space during the entry operations. The means of entry and exit, as well as the hazards posed by adjacent spaces, operations and conditions also need to be reviewed.

After identifying all the hazards, the next step is to evaluate them. Consideration should be given to: the number of employees that will be exposed; the type and amount of energy which may be released; the toxicity of the chemicals; the likelihood of an accident occurring; and the likely consequence of an incident occurring during an entry. For example, what will happen if an explosion occurs or if an entrant is exposed to chemical vapors? What effect are work tasks going to have inside the space? Once these questions have been answered, a strategy can be developed to control the hazards so the workers are adequately protected from them.

*(An entrant can be overcome by toxic gas O₂ (oxygen) deficiency, fall into a few inches of a liquid, and drown.)

Atmospheric Hazards

The most serious threat to the safety and health of the entrant is the atmosphere of the confined space. Atmospheric hazards, as mentioned, are by far the leading cause of death and serious injury.



The OSHA 1910.146 Standard breaks down atmospheric hazards into three different categories: oxygen deficient, flammable, and toxic. The following conditions are hazardous atmospheres which employees can encounter in a confined space:

- an oxygen concentration below 19.5% (oxygen deficient) or above 23.5% (oxygen enriched);
- a flammable or explosive atmosphere that has a gas, vapor or dust present at a concentration greater than 10% of their lower explosive limit (LEL);
- an atmospheric concentration of any toxic contaminant above the OSHA permissible exposure limit (PEL) or any other recommended standard;
- an airborne combustible dust at a concentration that obscures vision at a distance of 5 feet or greater;
- any immediately dangerous to life or health (IDLH) atmosphere.

Although some airborne dusts or particles may be easy to see, and some hazardous chemicals are easy to smell, there are other hazards such as oxygen deficiency and odorless chemicals (e.g. carbon monoxide) which cannot be detected by any of your senses. Therefore, appropriate and reliable instrumentation is necessary to protect workers from atmospheric hazards encountered in a confined space. The instrumentation will be discussed in Chapter 5, “Atmospheric Monitoring”, of this manual.

The types of atmospheric hazards which are likely to be found in confined spaces are briefly discussed:

Oxygen deficiency: A normal concentration of oxygen in air is 20.9%. An oxygen deficient atmosphere contains less than 19.5% of oxygen by volume. As the level of oxygen decreases, the adverse physiological effects increase. The effects of oxygen deficiency can be sudden or gradual depending on the oxygen concentration, levels of other gases in the atmosphere and physical work activity. The following chart depicts the symptoms.

% Oxygen Effects & Symptoms

>23.5	O ₂ enriched, increased change of fire and combustion
20.9	Normal percentage in air
19.5	OSHA/NIOSH minimal requirement
16-12	Increased pulse and respiration, impaired judgment and coordination
14-10	Fatigue, disturbed breathing, very faulty judgment
10-6	Nausea, vomiting, inability to move freely, unconsciousness followed by death
<6	Convulsion, death

Oxygen deficient atmospheres may be caused by oxygen being displaced by other gases such as nitrogen, which can result in a dangerous or immediately dangerous to life condition.

Oxygen deficiency can result from natural processes such as rust, corrosion, or other forms of oxidation. Decomposing organic matter, such as domestic waste and plant life, produce

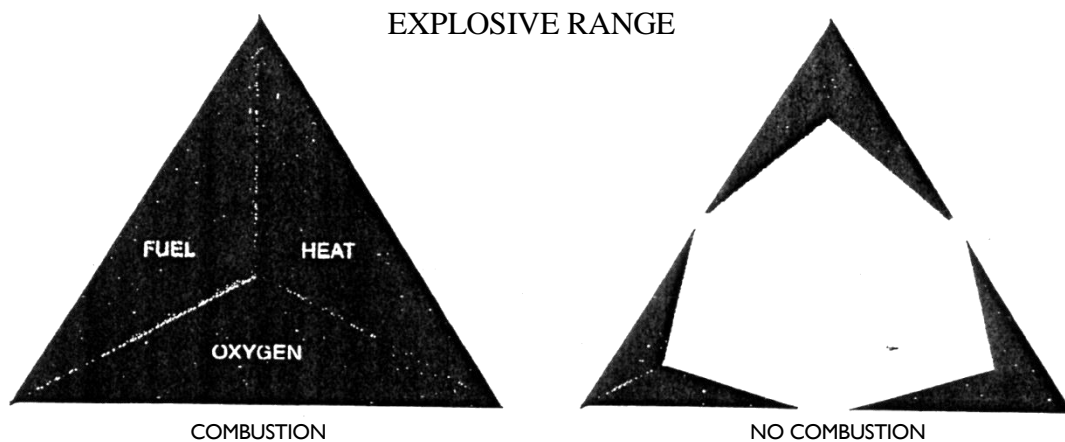


methane, carbon dioxide and hydrogen sulfide as oxygen is consumed. As materials decompose, oxygen is drawn from the atmosphere to fuel the oxidation process.

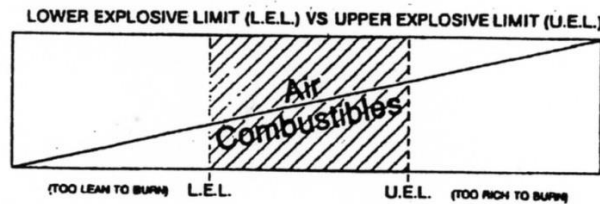
Excessive oxygen in concentrations above 23.5% by volume can also create a hazardous atmosphere. When oxygen increases above the normal level of 20.9%, it increases the flammability range of combustible gases or vapors and causes them to burn up violently. Excess oxygen also causes other combustible materials to burn violently. For example, there have been cases of workers being burned when their oxygen-enriched clothing ignited. Never purge confined spaces with pure oxygen in place of air. Improper blanking off of oxygen lines is another possible way for oxygen to enrich a confined space atmosphere.

Flammable/Combustible Gases

There have been many cases of fatalities in confined spaces because of fires and explosions. Most of these accidents occurred because the atmosphere was not monitored, explosion proof equipment was not used, or some other source of ignition was present. When fuel, oxygen and a source of ignition are present in the right mixture, a fire or explosion will occur. This situation is known as the fire triangle. If you remove any of the legs of the triangle, you can prevent combustion.



The percentage of combustible gas vapor in the air is the determining factor. All combustible gases/vapors have different flammable ranges. OSHA defines “flammable or explosive atmosphere” as one that poses the hazard when flammable materials are present at a concentration greater than 10% of their lower explosive limit.



The lowest concentration at which a vapor can ignite is its Lower Explosive Limit (LEL). Concentrations below this limit are too lean to burn. The highest concentration that can be



ignited is its Upper Explosive Limit (UEL). Above this concentration, the mixture has too much gas/vapor and not enough air to ignite.

An explosion occurs when the atmosphere has just the right combination of gas in air to explode. Care must be taken whenever there is a combustible gas present. A lean mixture can collect in low lying areas and form a combustible concentration. A mixture too rich to burn can be diluted by opening an access cover which allows air to enter and bring the mixture into the flammable range.

Toxic Hazards

Another potential atmospheric hazard in confined spaces are toxic contaminants which can be in the form of a liquid, solid or gas. These contaminants can produce an atmospheric condition which is immediately dangerous to life and health. A substance which is present in a concentration above its permissible exposure limit is also hazardous. Before a confined space can be entered, the toxic chemicals in them must be identified and the space tested to determine the concentration of these chemicals.

Some of the more common toxic chemicals found in confined spaces are:

Carbon Monoxide – A colorless, odorless, tasteless gas. It is usually created by internal combustion engines. In high concentrations of carbon monoxide, a worker may collapse with little or no warning and thus be unable to aid himself. Carbon monoxide is called the silent killer. Carbon monoxide poisoning can occur quite suddenly.

<u>PPM Level</u>	<u>Effects & Symptoms</u>
35	OSHA PEL (1989)
200-500	Headache and discomfort
600-1000	Dizziness, nausea, dull headache, heart pounding, ringing in ears
1500	Dangerous to life
4000	Unconsciousness and death will occur within a few minutes

Hydrogen Sulfide – H₂S can be extremely dangerous in the workplace. This colorless gas smells like rotten eggs, but a few breaths of it deadens the sense of smell. Therefore, do not count on the rotten egg smell to warn you of its presence. In high concentrations, hydrogen sulfide is flammable and explosive and will produce sulfur dioxide as a by-product, another toxic gas. Above all, H₂S is extremely toxic. It can cause unconsciousness and respiratory arrest.

<u>PPM Level</u>	<u>Effects & Symptoms</u>
10	OSHA PEL (1989)
15	OSHA STEL (15-minute exposure)
75-150	Slight eye, respiratory irritation
170-300	Marked irritation
400-600	Unconsciousness and death in one-hour
1000	Death in minutes
40000	4% volume LEL



Hydrogen sulfide can be found in waste water treatment systems, oil, paper, and chemical industries.

Engulfment Hazards

Engulfment hazards refer to situations where loose material such as sawdust or grains are stored and can trap or envelope the entrance. Often a dry bulk material is stored in confined spaces such as tanks or silos. Someone may enter what appears to be a solid surface but it may have a hidden air pocket underneath, which can collapse under the weight of the entrant. The weight of the material can compress the torso or the material can fill the respiratory system of the entrant, resulting in asphyxiation.

Entrapment Hazards

If the walls converge inward or the floor slopes down and tapers to a small cross section, there is a risk of being trapped or asphyxiated.

Mechanical Hazards

Confined spaces, because of their often tight configuration, can place entrants in dangerous proximity to physical and electrical hazards. Limited space can restrict the employee's ability to avoid these potentially fatal conditions.

Physical hazards such as grinding and mixing equipment, rotating gears and shafts can maim or crush entrants. This type of equipment is frequently not guarded in confined spaces because it is normally located where employees would not come in contact with them. Lockout and tagout procedures of all energy sources which are potentially hazardous to entrants must be employed to prevent the accidental start up of equipment before personnel are permitted to enter in confined spaces.

Biological Hazards

Biological hazards such as molds, mildew and pathogens frequently can be found in confined spaces such as sewer lines and hospital ventilation systems. These hazards can irritate the respiratory system or threaten the body with a variety of diseases.

Thermal Effects

Heat stress and hypothermia are potential confined space hazards. In confined spaces radiant heat, cold temperature, moisture content and air velocity may be difficult to control. In the colder months, sealing off confined spaces and the use of space heaters can produce an oxygen



deficiency or a lethal atmosphere to arise due to the accumulation of toxic gases such as carbon monoxide.

Noise

Noise levels are often elevated because sounds tend to reverberate in confined spaces. High noise levels can often times cause permanent hearing loss or may hinder communication between the entrant and the attendant causing them to miss important directions or warnings.

Other Hazards

Structural design, such as baffles, bends in tunnels, and multi-level spaces can present unique physical hazards which at the very least may complicate a rescue. Poor visibility, inadequate lighting, poor footing, unprotected drop offs, can add additional hazards to confined space entries. These spaces may also harbor rodents, snakes, spiders, all of which may be dangerous. Sudden changes in wind or weather can cause sudden changes in the confined space environment. Rain storms and water run-off, can suddenly increase water levels in catch basins, combined sewer lines, highway culverts, etc. When entering confined spaces, expect the unexpected. They can be extremely dangerous. That is why employees should never enter a confined space unless they have been authorized to enter, trained for the work task, and only after the space is certified as safe or a permit system is in place which controls exposure to the hazards in the confined space.



V.
Atmospheric Monitoring



ATMOSPHERIC MONITORING

The first requirement to entering a confined space is to identify the hazards. Most atmospheric hazards are invisible. Some have no smell. By the time an employee realizes that something is affecting him, it may be too late. The written permit must contain a list of the hazards present in the space. The PRCS program requires that the confined space be tested to determine if acceptable conditions are being maintained before commencing entry operations. OSHA requires testing to atmospheric hazards: first for oxygen, second for combustible gases and/or vapors and last for toxic vapors/gases. OSHA considers measuring and monitoring for atmospheric hazards as the most important step when making a confined space entry.

Every gas has a weight which is called its vapor density. Some gases are lighter than air while others like propane are heavier. A worker may test the opening of a confined space and it may seem safe for entry, but vapors inside the space may have risen to the ceiling or dropped to the floor. Pockets of contaminants can migrate into different areas within the space or may be moving down the line of a continuous system such as a sewer line.

It has frequently been observed that workers do not know how to properly use meters, how to calibrate them, and/or how the meters work. Atmospheric testing must be done properly. Employees must be trained to operate the instruments they use in entries. In addition, they must be trained to evaluate the hazards of confined spaces, the hazards to check, and the proper operation of the meters.

Battery powered, direct reading instruments are considered to be the most practical devices for monitoring confined spaces on a periodic or continuous basis. These monitoring devices are classified into two groups: single gas monitors like the classic MSA explosimeters, or a variety of multiple gas instruments which are on the market today. As mentioned above, the OSHA PRCS standard requires confined spaces to be checked for multiple atmospheric hazards. Regardless of the type of instrument used to check the atmosphere, regular monitoring must be performed during all confined space operations since a contaminant's level of combustibility or toxicity can increase during an entry.

Some companies have a policy to monitor atmospheres continuously, not just prior to entry or after a break. While working in a space, the atmosphere may change due to a leak or work activities. A monitor will be able to detect a change before the entrant does.

Monitoring instruments must be working properly. The device must be calibrated according to the manufacturer's recommendations, calibration procedures and intervals. Designated atmospheric monitors must be taught all aspects of the instrument's use and limitations.

In many confined spaces, there may be a high concentration of gases present at the entry point. If there is a sampling port, as in some manhole covers, place the probe in first to make sure that it is safe to open the cover. There have been cases when a spark produced by an opening tool was enough to ignite an explosive atmosphere inside the space. Prior to checking for combustible vapors, it is a good idea to place the probe in first without the meter running to check if it gets wet from a high-water level. Water or other fluids pumped into the meter will

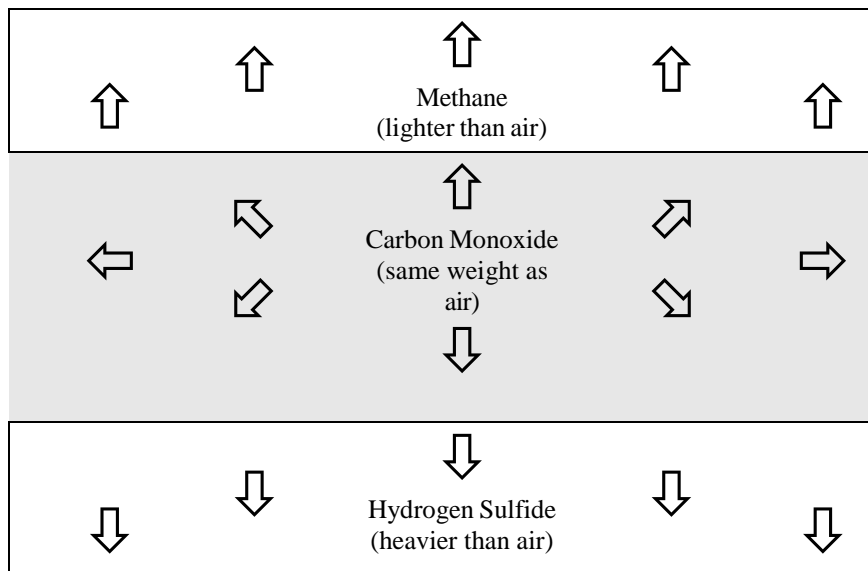


cause costly damage to the cells. Depending on your type of operations, it may be a good idea to invest in water traps and dust filters in order to prevent costly repairs.

Opening a cover completely, without first monitoring, may cause several different conditions to arise. It could dilute a too rich combustible atmosphere so that it is in the flammable range, or it can disperse toxic contaminants so that an artificially low gas concentration is found.

Atmospheric testing should be conducted at all levels within the confined space. Some gases such as methane are lighter than air and tend to collect at the top of the space. Other gases such as hydrogen sulfide, which is 2.5 times heavier than air, will collect near the bottom. Other contaminants may have the same vapor density as air and may be mixed throughout the space.

This requires that sampling be done on all levels of the space to ensure that the atmosphere is safe.



The results of atmospheric monitoring will have a direct impact on the type of entry permitted, the type of personal protective equipment selected, and possibly how long an entrant may remain in the confined space environment.

It must be assumed that every PRCS has the potential to have a hazardous atmosphere. No one should ever be allowed to make an entry without first checking the atmosphere, even if the entry is “just for a minute”.

Another concern for confined space atmospheres is that the work performed inside a space may change a once safe atmosphere into a dangerous one. Activities which include combustion processes such as welding, heating, cutting, brazing, can consume oxygen or produce toxic contaminants such as carbon monoxide, or toxic metal fumes. Cleaning processes can also create hazardous atmospheres. Cleaning sewer sludge can liberate hydrogen sulfide vapors.



Cleaning solvents or paint vapors can be liberated into the air and remain inside the space due to a lack of ventilation.

Some points to remember when sampling are:

- Air tends to stratify in confined spaces. Be sure to measure it at various levels.
- Become familiar with the hazards in your confined spaces.
- Drawing liquids through the monitoring device may damage the instrument.
- When doing remote sampling, be careful not to immerse or draw liquids into the instrument.
- Perform regular calibration and maintain the monitoring equipment properly to ensure optimum function.

Information on atmospheric monitoring devices can be obtained from sources listed in Appendix D.



I.

Tools and Equipment



4. TOOLS AND EQUIPMENT

There is a wide range of equipment which is used to protect workers in confined spaces. It is essential that all entries are preplanned so that suitable equipment is selected. NIOSH studies of confined space entry fatalities indicate that they are frequently caused by a lack of proper equipment, little or no training and failure to follow safety rules and procedures. An employee should never enter a confined space without the proper equipment and training.

Communication Equipment

The OSHA standard requires attendants and entrants to be able to communicate with each other. The standard also requires that communication equipment be available to quickly summon rescue services in the event of an emergency. In a small confined space, when the entrant is near the entrance, communication can be accomplished by voice or hand signals. The type of communication depends on the situation. When possible, the best method is for the attendant to see the entrant. He can see if the entrant is experiencing early signs or symptoms of exposure. Because background noise or respirators may interfere with the units of communication equipment, hand signals may be a good method. Entrants and attendants may signal each other by tugging on a life line which is attached to the entrant.

Two-way radios are frequently used in confined space entries. Models are available which are compatible with supplied air systems. Battery operated voice activated radios are frequently used because they permit workers to communicate with each other without having to use their hands to hold radios. While two-way radios may seem like the best means of monitoring communications, the batteries can go dead, are subject to interference, or may be out of range within confined space. Care must also be used so that they are intrinsically safe when used in combustible atmospheres.

Lighting

Confined spaces frequently do not have a built in source of light. The OSHA Standard requires sufficient lighting to enable workers to work safely and exit the space in an emergency. When portable light sources are used, it is important, as with any electrically powered tool, that they are not used in a flammable environment, unless they are explosion proof. Two wastewater treatment workers were blown up when they lowered an ordinary light bulb into a digester which contained an explosive concentration of methane.

Personal Protective Equipment

Selection of personal protective equipment (PPE) cannot be made until a hazard assessment is made of the confined space. Once the hazards have been identified and quantified (air monitoring) the proper PPE can be selected. The types of PPE available should be listed on the entry permit and contained in the written permit program.



PPE can protect the entrant from a wide variety of hazards. PPE for confined spaces can be broken into two categories; respiratory protection and protective clothing.

Respirators

Once the atmosphere of confined space has been measured, the proper type of respirator can be selected, if needed. Respirator choice should be based on the type of hazard present and the concentration of the contaminant. OSHA has assigned protection factors (PF) for each type of respirator, indicating the maximum contaminant level for which the respirator can be used.

OSHA has established Permissible Exposure Limits (1910.1000) for various contaminants. Workers cannot legally be exposed to contaminants above the maximum time weighted average established by OSHA. The proper respirator can be chosen by its PF and the concentration of the contaminants in the confined space. For example, a respirator with protection factor of 100 can be worn to protect the entrant when the measured concentration of a particular contaminant does not exceed 100 times its PEL. Confined space atmospheres which do not have at least 19.5% oxygen, require a supplied air respirator for entering.

If employees are expected to wear a respirator, the employer must institute a respiratory protection program (see 29CFR 1910.134). This includes proper respirator selection, employee training, fit testing, etc. There is a sample respiratory program developed by 3M in Appendix B.

- **Air Purifying Respirators**

Air purifying respirators do just as they say. They draw air through a filter to purify or clean it before it enters the body. These types of respirators use cartridges and filters to remove gas, vapor, dust and fumes. The filters and cartridges come in various sizes and are designed to trap or absorb specific types of contaminant. Both cartridges and filters are good for only a limited time. When chemical cartridges become saturated, the gas vapors can start to pass through them. This is called breakthrough. Filters become clogged causing the wearer to feel increased resistance when breathing. When a wearer notices either of these signs, it is time to change the cartridges/filters.

Air purifying respirators are used because they are relatively light weight and comfortable. The face pieces are either a half-mask or full face piece. If the confined space contaminants are eye irritants, a full face piece is necessary. Full face pieces are often used in confined spaces because they provide a better seal and eye protection. Air purifying respirators can only be used in confined spaces which have at least 19.5% oxygen and known concentrations of contaminants. The air purifying respirator cannot be used in confined space entries where there are unknown concentrations of contaminants or the possibility of oxygen deficiencies.



- **Self-Contained Breathing Apparatus**

Self-contained breathing apparatus (SCBA) differ from air purifying respirators because they provide supply air. They are designed to provide protection in oxygen deficient conditions, immediately dangerous to life atmospheres, or when high concentrations of contaminants occur in confined spaces. SCBAs used in these spaces should have light weight composition cylinders instead of the heavy steel cylinders.

The practice of allowing workers to first enter the space through a manhole opening and then lower the SCBA into the entrant must not be allowed. There are cases when entrants have passed out before the SCBA was provided.

SCBAs have air supplies in 30 minute and 60 minute cylinders. Although SCBAs are equipped with low pressure alarms which sound at 25% capacity, it is a good idea to have entrants and attendants trained to monitor their time to allow enough time to complete the task and exit. The advantages of SCBAs include increased mobility and the ability to work in IDLH environments. The disadvantages are the increased weight, time constraints, and their inability to fit through narrow openings.

- **Supplied Air Respirators**

Supplied air respirators (SAR) are designed to supply air to the user through an air line. A standard SAR must contain a small SCBA with a 5-10 minute air cylinder approved by NIOSH for escape purposes. SARs are particularly well suited for confined space entry because they allow the entrant to move about in the confined space and also make it easier to enter and exit through small openings. Manufacturers have recently developed a variety of SAR configurations. Consult with your supplier to determine which units are most suitable for your type of confined spaces.

Other types of SARs used in confined spaces are hooded and helmet types which are used for particular work tasks such as sandblasting, painting, or grinding.

Combination SAR/SCBAs merge the capabilities of an air line unit and an SCBA. These units contain a regulator with two inlets, one for the high-pressure air cylinder and another for intermittent connection to an air supply hose. The advantage of these units is that they provide the mobility of an SCBA, when it is disconnected from the cylinder. Another advantage is the extended air supply when connected to an outside air supply.

Protective Clothing

There is a wide variety of clothing designed to protect entrants from a range of hazards such as corrosive chemicals, cuts and abrasions, and falling objects. The proper selection of protective clothing will depend on the types of hazards and work performed in the confined space.



The clothing may be simple cotton work clothes, jumpsuits which contain built in harnesses for fall protection or totally encapsulated chemical protective suits.

Thermal conditions – It is quite possible to have either cold or hot environments depending on factors such as the climate and the nature of the space. Protection may be as simple as layering clothing to protect entrants from the cold.

Heat stress can present a major problem due to the constricted nature of the space, a lack of ventilation and wearing chemical suits and an air pack. There are specially designed vests and suits which cool the body through ice packs or fluids which are pumped through tubes sewn into clothing.

Chemical Protective Clothing

Chemicals such as corrosives can directly damage the skin or can be absorbed through the skin and enter the body's blood stream. Therefore, use of chemical protective clothing which acts as a barrier between the skin and chemicals is essential. There are many types of chemical protective clothing: gloves, boots, aprons, face shields, and goggles. Rain suits, specially coated Tyvek or totally encapsulated suits may be necessary because the constricted space can place the entrant in close proximity to the chemical hazard. Other types of clothing can include spark/flame resistant clothing used when performing operations such as cutting, grinding and welding. Sand blasting, water hazards, and any other hazards may require special measures.

Eye, Head, and Hearing Protection

The last area of PPE is the various types of protection for the head. Eye protection can protect from a number of hazards. Safety glasses with side shields and goggles provide impact protection from hazards generated by cleaning, chipping, or drilling. Full face shields protect more of the face from flying debris and chemical splashes. Welding goggles and face shields are required for cutting and welding. Eye and face protection should meet the criteria specified in the ANSI Z87.1-1989 Standard.

Head protection in the form of protective hats must be able to resist penetration, absorb the shock of a blow and protect against electric shock. It comes in several varieties, either helmets or hard hats/caps. Protective caps are designed for overhead protection as well as side impacts from butting into stationary objects. Hard hats should conform to the ANSI Z89.1-1986 Standard.

Exposure to high noise levels can cause irreversible injury, hearing loss or impairment. It can also create physical and psychological stress. High noise levels in confined spaces are often caused by grinding, welding, hammering, etc. Due to the restrictive configurations of confined spaces, sound reverberates and is amplified resulting in high (greater than 85 dBA) noise levels. In many cases, hearing protection is a must. Hearing protection is available in two forms: ear plugs and ear muffs. OSHA requires that employees be given a choice of at least two different types of hearing protection.



Fall Protection/Retrieval Systems

Entering confined spaces often involves the risk of a vertical free fall hazard when climbing down or being lowered into a space. Rescuing someone in a confined space exposes the rescuer to the danger of being overcome and trapped, particularly if they are entering through a small opening. When the proper equipment is used, rescuers will not have to enter the confined space in order to rescue the victim.

The type of retrieval equipment required is dependent on the type of entry. The size and opening to the space, obstacles within the space, the number of occupants, the type of retrieval equipment, and whether it is a vertical or horizontal entry should all be considered.



Because of fall and rescue hazards, OSHA requires the use of a retrieval system in all vertical entries greater than 5 feet deep. These systems consist of a heavy duty life line, a tripod or other suitable anchorage point and a personnel winch. Most manual winches are designed to lift workers up to 50 feet in the range of 20 feet per minute. This will allow rescues to be accomplished within 3-4 minutes. It would be virtually impossible for the average worker to hoist someone out of a manhole without this mechanical advantage.

For depths which are greater than 50 feet, retrieval system manufacturers recommend a powered winch to provide a quicker ascent. These winches must be self-breaking to prevent free falls and to hold personnel in place. These devices should be sent back to the manufacturer for an annual re-certification. Frequently, another winch is used for material handling, lifting and lowering tools and equipment for the entrant.



Full body harnesses with a back D-ring are used instead of safety belts due to their ability to dissipate force. The support and comfort the entrant receives, plus dissipation of the shock which can be transmitted to a worker during the arrest of the fall, more than compensates for any inconvenience real or imagined that a worker may experience. Harnesses typically absorb shock through the shoulders and thighs while keeping the body upright which aids in vertical retrievals. There are harnesses which are integrated into coveralls, which allow lifelines to be attached directly to the garment.

In emergency situations, wristlet type harnesses are used to quickly extract fallen workers from the space by pulling the arms over their heads and raising the worker. This arrangement, even more than the body harness keeps the victim vertical and reduces the chances that the worker's head or shoulders will hit or catch on a narrow-confined space opening.

OSHA requires vertical lifelines to be rated for 5,400 lbs. Certain lifelines such as self-retracting units built into winches are not subject to the same typically high dynamic loads. These units can limit free fall to two feet or less and the line and anchorage strength needs only to have a 3000 lb. rating. OSHA limits free falls to a maximum of 6 feet when belts, lanyards, and lifelines are used. The deceleration force to the workers is substantially decreased by reducing the length of the fall, so look for equipment that reduces free fall to 2 feet.

Fall protection/fall arrest equipment is regulated by numerous committees and organizations specifically:

- ANSI Standard 810.14-1975 – Safety Belts, Harnesses, Lanyards and Lifelines For Construction And Industrial Use.
- OSHA 29 CFR 1910.66 Appendix C – Personal Fall Arresting Systems For Powered Platforms For Building Maintenance.
- OSHA 29 CFR 1910.268(g) – Personal Climbing Equipment
- OSHA 29 CFR 1926.104 – Safety Belts, Lifelines and Lanyards.
- OSHA 29 CFR 1926.959 – Lineman's Body Belts, Safety Straps & Lanyards.

Equipment users must be fully trained and knowledgeable in all regulations and workplace requirements in which the fall protection equipment is to be used.

Equipment users must undergo a formal training program which includes:

- Information about local, state, and federal government regulations.
- Hands on application training.
- Anchor point and proper tie off techniques.
- Guidance and demonstration of inspecting and maintaining the equipment.

Tools

Tools for confined space entry should be assembled prior to entry into the space. Provisions should be made on how tools will be lowered and raised without endangering the entrant.



Tools and equipment should not be placed adjacent to a vertical entry to prevent someone from kicking these tools down onto the entrant.

It is mandatory that only non-sparking, air powered, or explosion proof tools be used in an explosive or flammable atmosphere. All electrical equipment used in hazardous atmospheres should meet Article 500 of the National Electric Code (NFPA-70). Because sparks can be produced by striking and grinding operations or by static electricity, it is best not to enter a flammable/explosive environment unless the employer is equipped and experienced with this type of hazard.

The OSHA standard requires the employer to take effective measures to prevent non- authorized people from entering confined spaces. Barricades, traffic control devices, etc., should be placed around open manholes and other confined space entry points to protect passersby and the entrant.



Sample Entry Form and Definitions



Acceptable Entry Conditions means the conditions that must exist in a permit space to allow entry and to secure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

Air Monitoring means the sampling for and measuring of pollutants in the atmosphere.

Asphyxia means suffocation from lack of oxygen. Chemical asphyxia is produced by a substance such as carbon monoxide that combines with hemoglobin to reduce the blood's capacity to transport oxygen. Simple asphyxia is the result of exposure to a substance, such as methane, that displaces oxygen.

Asphyxiant means a vapor or gas that causes unconsciousness or death by suffocation (lack of oxygen). They are the major hazard of working in confined spaces.

Attendant means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employee's permit space program.

Authorized Entrant means an employee who is authorized by the employer to enter a permit space.

Barrier means a physical obstruction that blocks or limits access.

Blanking or Blinding means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line or duct with no leakage beyond the plate.

Combustible is a term that OSHA, NFPA and DOT use to classify certain materials with low flashpoints that ignite easily. Combustible liquids are those having a flashpoint at or above 100 degrees Fahrenheit but below 200 degrees.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them

Confined Space means a place that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work; and
2. Has limited or restricted means of entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults and pits are spaces that may have limited means of entry); and
3. Is not designed for continuous employee occupancy.

Control means the action taken to reduce the level of any hazard inside a confined space using engineering methods (for example, by ventilation), and then using these methods to



maintain the reduced hazard level. Control also refers to the engineering methods used for this purpose. Personal protective equipment is not a control.

Controlling Contractor is the employer that has overall responsibility for construction at the worksite. Note. If the controlling contractor owns or manages the property, then it is both a controlling employer and a host employer.

Double Block and Bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Early-warning system means the method used to alert authorized entrants and attendants that an engulfment hazard may be developing. Examples of early-warning systems include, but are not limited to: alarms activated by remote sensors; and lookouts with equipment for immediately communicating with the authorized entrants and attendants.

Emergency means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment means that surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry Employer means any employer who decides that an employee it directs will enter a permit space.

Note. An employer cannot avoid the duties of the standard merely by refusing to decide whether its employees will enter a permit space, and OSHA will consider the failure to so decide to be an implicit decision to allow employees to enter those spaces if they are working in the proximity of the space.

Entry Permit (permit) means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in paragraph (f) of the standard.

Entry rescue occurs when a rescue service enters a permit space to rescue one or more employees.

Entry Supervisor means the person (such as employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is



planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

NOTE: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Flammable means any solid, liquid, vapor, or gas that ignites easily and burns rapidly. Any liquid with a flashpoint below 100 degrees Fahrenheit is flammable.

Flammable Limit means the range at which materials will ignite. Flammables have a minimum concentration below which propagation of flame does not occur on contact with a source of ignition. This is known as the lower flammable explosive limit (LEL). There is also a maximum concentration of vapor or gas in air above which propagation of flame does not occur. This is known as the upper explosive limit (UEL). These units are expressed in percent of gas or vapor in air by volume.

Hazard means a physical hazard or hazardous atmosphere. See definitions below.

Hazardous Atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
2. Airborne combustible dust at a concentration that meets or exceeds its LFL;

NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

3. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit.

NOTE: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment or ability of self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

5. Any other atmospheric condition that is immediately dangerous to life or death.



NOTE: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Safety Data Sheets that comply with the Hazard Communication Standard, 1910.1200 of this Part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Host employer means the employer that owns or manages the property where the construction work is taking place.

NOTE: If the owner of the property on which the construction activity occurs has contracted with an entity for the general management of that property, and has transferred to that entity the information specified in §1203(h)(1), OSHA will treat the contracted management entity as the host employer for as long as that entity manages the property. Otherwise, OSHA will treat the owner of the property as the host employer. In no case will there be more than one host employer.

Hot Work Permit means the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately Dangerous To Life or Health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

NOTE: This procedure produces an IDLH oxygen-deficient atmosphere.

In Plant Rescue means a group or two or more employees designated and trained to perform rescues in permit spaces in their plant.

Isolation means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Limited or restricted means for entry or exit means a condition that has a potential to impede an employee's movement into or out of a confined space. Such conditions include, but are not limited to, trip hazards, poor illumination, slippery floors, inclining surfaces and ladders.

Line Breaking means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.



Lockout means the placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lower Explosive Limit (LEL) means the lower limit of flammability of a gas or vapor at ordinary ambient temperatures expressed in percent of the gas or vapor in air by volume.

Monitor or monitoring means the process used to identify and evaluate the hazards after an authorized entrant enters the space. This is a process of checking for changes that is performed in a periodic or continuous manner after the completion of the initial testing or evaluation of that space.

Non-entry rescue occurs when a rescue service, usually the attendant, retrieves employees in a permit space without entering the permit space.

Non-Permit Confined Space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or physical harm.

Oxygen Deficiency means an atmosphere containing less than 19.5% oxygen by volume.

Oxygen Enriched Atmosphere means an atmosphere containing more than 23.5% oxygen by volume.

PEL – Permissible Explosive Limit means an exposure limit that is published and enforced by OSHA as a legal standard.

PPE – Personal Protective Equipment means devices worn by the worker to protect against hazards in the environment. Respirators, gloves, and hearing protectors are examples.

PPM – Parts Per Million means parts per million of air by volume of vapor or gas or other contaminant.

Permit Required Confined Space (permit space) means a confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
4. Contains any other recognized serious safety or health hazard.

Permit Required Confined Space Program (permit space program) means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.



Permit System means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Physical hazard means an existing or potential hazard that can cause death or serious physical damage. Examples include, but are not limited to: explosives (as defined by paragraph (n) of §1926.914, definition of "explosive"); mechanical, electrical, hydraulic and pneumatic energy; radiation; temperature extremes; engulfment; noise; and inwardly converging surfaces. Physical hazard also includes chemicals that can cause death or serious physical damage through skin or eye contact (rather than through inhalation).

Prohibited Condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized. A hazardous atmosphere is a prohibited condition unless the employer can demonstrate that personal protective equipment (PPE) will provide effective protection for each employee in the permit space and provides the appropriate PPE to each employee.

Qualified person means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

Representative permit space means a mock-up of a confined space that has entrance openings that are similar to, and is of similar size, configuration, and accessibility to, the permit space that authorized entrants enter.

Rescue means retrieving, and providing medical assistance to, one or more employees who are in a permit space.

Rescue Service means the personnel designated to rescue employees from permit spaces.

Retrieval System means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

***NOTE:** Testing enables employers both to devise and implement adequate control measures for the protection and authorized entrants and to determine if acceptable entry conditions are present prior to, and during, entry.*

Serious physical damage means an impairment or illness in which a body part is made functionally useless or is substantially reduced in efficiency. Such impairment or illness may be permanent or temporary and includes, but is not limited to, loss of consciousness, disorientation, or other immediate and substantial reduction in mental efficiency. Injuries involving such impairment would usually require treatment by a physician or other licensed health-care professional.



Tagout means:(1) Placement of a tagout device on a circuit or equipment that has been deenergized, in accordance with an established procedure, to indicate that the circuit or equipment being controlled may not be operated until the tagout device is removed; and (2) The employer ensures that (i) tagout provides equivalent protection to lockout, or (ii) that lockout is infeasible and the employer has relieved, disconnected, restrained and otherwise rendered safe stored (residual) energy.

Test or testing means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Note. Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to, and during, entry.

TLV – Threshold Limit Value means a time weighted average concentration under which most people can work consistently for 8 hours a day, day after day, without any harmful effects. A table of these values and accompanying precautions is published annually by the American Conference of Governmental Industrial Hygienists.

UEL/UFL – Upper Explosive/Flammable Limit means the highest concentration (expressed in percent vapors or gas in the air by volume) of a substance what will burn or explode when an ignition source is present.

Vapor Density means the weight of a gas or vapor compared to the weight of an equal volume of air, an expression of the density of the vapor or gas calculated as the ratio of the molecular weight of the gas to the average molecular weight of air, which is 29. Materials lighter than air have vapor densities of less than 1.0. Materials heavier than air have vapor densities greater than 1.0. All vapors and gases mix with air, but the lighter materials tend to rise and dissipate (unless confined). Heavier vapors and gases are likely to concentrate in low or enclosed places (under floors, in manholes, tanks, ditches, etc.) creating fire, explosion or health hazards.

Ventilate or ventilation means controlling a hazardous atmosphere using continuous forced-air mechanical systems that meet the requirement