

Building a Safety Program for Your Organization

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Confined Space

A **confined space** must meet *all* of the following criteria:

1. It is large enough and is constructed to permit the employee to bodily enter the space to perform work.
2. It has limited or restricted means of entry and exit.
3. It is not designed for continuous employee occupancy.

Examples of Confined Spaces

- Storage tanks
- Process vessels
- Dumpsters
- Boilers/fire boxes
- Open surface tanks
- Storm drains
- Manholes
- Railroad tank cars
- Crawlspace
- Suspended ceilings

What is a Permit-Required Confined Space?

A *permit-required* confined space has all **three** of the following characteristics:

- Large enough and so configured that an employee can bodily enter and perform assigned work
- Has limited or restricted means for entry or exit
- Is not designed for continuous employee occupancy

A *permit-required* confined space also has at least **one** of the following characteristics:

- Contains (or has the potential to contain) a hazardous atmosphere
- Contains a material that has the potential for engulfing an employee
- Has an internal configuration of such that an entrant could be trapped or asphyxiated by inwardly converging walls, or by a floor that slopes downward and tapers to a smaller cross section
- Contains any other recognized serious safety or health hazard

What is a Non-Permit-Required Confined Space?

- A confined space that does not contain (or have the potential to contain) any hazard capable of causing death or serious physical harm, including atmospheric hazards.
- Spaces that have had all hazards eliminated can be reclassified as non-permit-required spaces, as long as the hazard remains eliminated.

Examples of non-permit-required confined spaces:

- Vented vaults
- Motor control cabinets
- Dropped ceilings

OSHA Confined Space Standard Requirements of the Employer:

- Identify **all** confined spaces (permitted and non-permitted).
- Characterize the spaces for hazards.
- Develop written confined space procedures and permit system.
- Provide training and equipment to employees for confined space tasks.
- Only authorized employees may enter the confined space.
- Establish an employee monitoring system and empower them to enforce the entry rules.

OSHA Confined Space Standard Requirements of the Employee:

- Enter confined spaces only where authorized and trained to do so.
- Know and understand the hazards associated with each confined space.
- Follow the written confined space instructions established by the employer.
- Complete an entry permit for permit-required confined spaces.
- Provide emergency rescue only if trained for such emergencies.

Contractor Responsibilities

Employer Responsibilities to Contractors

When an employer arranges to have employees of a contractor perform work that involves permit-required space entry, the responsibilities of the employer (host) include:

- Inform the contractor that the workplace contains permit-required spaces and that permit-required space entry is permitted only if it meets the requirements of the OSHA Confined Space Standard.
- Inform the contractor of the hazards identified and of the host employer's experience with the space.
- Inform the contractor of any precautions or procedures that the host employer has implemented to protect the employees working on or near a confined space.
- Coordinate entry operations with the contractor when both host and contractor will be working in or near the confined space.
- Debrief the contractor at the end of the confined space entry operation.

Contractor Responsibilities to the Host Employer:

- Obtain any available information concerning the permit-required space hazard and entry operations.
- Coordinate the entry operation with the host employer if both host employer personnel and contractor personnel will be working in or near the permit-required spaces.
- Advise the host employer during the operation about any hazards created or identified within the confined space.
- Debrief the host employer at the end of the confined space operation.
- Confined Space Signage
- All permit-required confined spaces must be identified by the employer.
- Signage is based on the results of the hazard evaluation.
- Each confined space must be labeled, based on the evaluation results.

Confined Space Hazards

Permit-Required Confined Space Hazards

- Entrapment design — walls curve in, floors slope and taper down, potential exists to slip and fall into an area too small to escape from or be pushed into machinery.
- Engulfment potential is created by the flowable material in the space. The material does not have to be deep enough to cover the worker's head — chest high will cause enough pressure on the body to prevent breathing and damage internal organs.
- Hazardous atmosphere, including:
 - Fire or explosive risks associated with the gas, vapor and mist
 - Airborne dust, which can be combustible, explosive, and a visibility hazard
 - Oxygen deficiency or enrichment
- Other recognized dangers:
 - Fire
 - Electrical or physical hazards
 - Thermal hazards (cold stress and heat stress)
 - Slips and falls
 - Contact hazards; poisons

Oxygen Respiratory Effects

Oxygen %	Effect
20.9	Normal
19.5	Safety limit
17	First sign of hypoxia, increase in breathing and heart rate
16	Impaired judgment and breathing
14	Increased breathing volume and heart rate; attention, thinking and coordination impaired
12.5	IDLH
10	Faulty judgment and muscular coordination difficulties
6	Spasmodic breathing and convulsive movements; death in minutes

Flammability

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- Look for the obvious, and the not so obvious, fire risks — even an empty, used tank should be tested for trace flammable substances that could burn or explode.
- Flammable vapors, gases, mist and dusts in a confined space can be easily ignited by:
 - Welding and grinding sparks
 - Smoking
 - Unapproved electrical equipment
 - Metal friction

Toxicity

- Gases, dust, mist or vapors should not exceed the substance's Permissible Exposure Limits (PEL)
- Carbon Monoxide — does not have a smell; it is created by internal combustion and replaces the oxygen in the bloodstream
- Hydrogen sulfide — has a rotten egg smell; it will affect the body by stopping respiration
- Sulfur dioxide — has a heavy smell and is poisonous even in small amounts

Physical Hazards

- Moving machinery
- Exposed electrical
- Heat and cold stress
- Liquids and gases entering a space could result in drowning, poisoning or burning the worker
- Falls
- Electrocution
- Noise

Evaluating Spaces to Determine the Presence of Hazards

- Before permitting any work in a confined space to take place, the following:
 - Atmosphere tests should be conducted:
 - Oxygen content
 - Flammable gases and vapors
 - Potential toxic air contaminants
 - Contact poisons
- Calibrate the instruments before and after every use.
- Test the space *before* it is open for oxygen and combustibility.
- *After* opening the space, test from the top to the bottom of the space or, if entering a horizontal space; in the direction of travel.

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- Test around every corner, duct, pipe, and any place where gas may build up or sink.
- Toxicity testing takes place only *after* test results for oxygen come back within the normal limit.
- If the results indicate the presence of breathing hazards, clean forced-air ventilation may be used to remove them through purging or flushing.
- If flammable airborne hazards are detected, the space may be purged with an inert gas (inerting). The inerting must be followed by forced air ventilation with fresh air.
- Continuously ventilate the occupied space and test the air as necessary.

Permit Entry Program

A permit entry program involves:

- Identifying and evaluating the confined space hazards
- Permitting only authorized employees to enter
- Posting signs
- Keeping vehicles and people away from the confined space
- Training
- Providing the needed equipment
- Establishing and practicing rescue procedures
- Creating and posting a detailed entry permit
- Communication
- Use of attendants and entry supervisors
- Using the correct personal protective equipment
- Methods to rescue attendants during an emergency

Permit System

A permit system is the employer's written procedure for preparing and issuing permits for entry, and for returning the permit-required space to service following completion of entry.

Entry is the action by which an individual, or any *part* of the individual's body, breaks the plane of an opening into the permit-required confined space.

- Before entry begins, the entry supervisor identified on the permit shall sign the entry permit to authorize the entry.
- The completed permit shall be made available to all authorized entrants by posting it at the entry portal, or by any other equally effective means. This allows entrants to confirm that pre-entry preparations have been completed.
- The length of the permit may not exceed the time required to complete the job listed on the permit.
- The entry supervisor shall terminate the entry and cancel the permit when:

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- The entry operation covered by the entry permit has been completed
- A condition that is not permitted under the entry permit arises in or near the permit-required space.
- Any individual who has been designated as the entry supervisor has the right to terminate entry and cancel a permit.
- All cancelled entry permits shall be retained for at least one year from the date of entry.
- Any problem encountered during an entry operation shall be noted on the pertinent permit. This data will be used for appropriate revisions to the permit-required space program.

Entry Permit

An entry permit is the written or printed document that is provided by the employer to allow and control the entry into a permit-required space. All sections of the form must be completed. The entry permit shall identify the following:

- The permit-required space to be entered.
- The purpose of the entry.
- The date and authorized duration of the entry permit.
- The authorized entrants shall be listed by name, through the use of rosters or a tracking system. This will enable the attendant to determine which entrants are inside the confined space.
- The attendants, by name.
- The entry supervisor, by name, with a place for the entry supervisor's signature (this should be the individual who originally authorized the entry).
- The hazards of the permit-required space.
- The measures taken to isolate the permit-required space, and those taken to eliminate or control it before entry.
- The acceptable entry conditions.
- The results of the initial and periodic testing performed, along with the initials of the person who performed the tests.
- The rescue and emergency services that will be responding if necessary.
- The communication procedures used by authorized entrants and attendants during the entry.
- Equipment to be used during the entry.
- Any other information necessary in order to ensure employee safety.
- Any additional permits (such as hot work) to authorize work in the permit space.

The Permit-Required Confined Space Team:

- Entry Supervisor

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- Authorized Entrant
- Attendant
- Rescue and Emergency Services

Duties of the Entry Supervisor

- Be aware of the hazards that may be faced during entry
- Verify that the appropriate entries have been made
- Terminate the entry and cancel the permit as required
- Verify that rescue services are available and that the means to summon them are operable
- Remove unauthorized individuals who enter, or attempt to enter, the permit-required space during entry operations
- Keep entry operations consistent

Duties of the Authorized Entrant

- Be aware of the hazards
- Use the proper equipment
- Communicate with the attendant as necessary to monitor the entrant's status
- Alert the attendant whenever a warning sign, symptom, or exposure to a dangerous situation occurs, or when a prohibited condition is detected
- Exit from the permit-required space as quickly as possible

Duties of the Attendant

- Be aware of the hazards
- Be aware of the possible behavioral effects of the hazards
- Continuously maintain an accurate count of authorized entrants in the permit-required space
- Remain outside the permit-required space during operations until relieved by another attendant
- Communicate with the authorized entrants as necessary to monitor their activities
- Monitor activities inside and outside the space to determine if it is safe for entrants
- Summon rescue services if necessary
- Prevent unauthorized persons from approaching or entering a permit-required space area while entry is underway
- Use non-entry rescues
- Perform no duties that might interfere with the attendant's primary duty — to monitor and protect the entrants

Duties of the Rescue and Emergency Services

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- Each member of the emergency services crew must be trained in the proper use of personal protective equipment and rescue equipment
- Have prior training before being assigned rescue duties
- Practice making permit-required space rescues at least once every 12 months into representative confined spaces
- At least one member of the rescue team must be certified in 1st Aid and CPR
- Have the ability to facilitate a non-entry retrieval

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Sample Permit

PERMIT-REQUIRED CONFINED SPACE ENTRY PERMIT

THIS PERMIT SHALL BE ISSUED BY AN ENTRY SUPERVISOR AND SHALL BE DISPLAYED AT EACH POINT OF ENTRY TO THE CONFINED SPACE.

PLEASE PRINT DATE WHEN PERMIT WAS ISSUED ___/___/___ TIME: _____

Name and location of permit-required confined space area and purpose of entry: _____	
Names of employees approved for entry. No other person(s) may enter the permit-required confined space . UNAUTHORIZED ENTRY IS FORBIDDEN.	
Name -Authorized Entrants _____	Name-Authorized Entrants _____
Expiration Date: _____	Time: _____ Attendant _____

The entry supervisor must inspect and complete this section before first entry of work shift. After each absence, the atmosphere must be retested by an entry supervisor. An entry supervisor must be on-site during entry.

Item	YES	NO	COMMENT
Are all lines disconnected or blanked off (electrical, steam, hydraulic, pneumatic)?			
Is power locked out in accordance with OSHA regulations?			
Has the permit-required confined space been properly vented? Circle ventilation method: mechanical • natural			
Is acceptable air quality present? Oxygen-19.5% to 23.5% LFL-Less than 10% Toxic- Not to exceed PEL(s) (CO 35 ppm/H ₂ S 10 ppm) Dust-Not to obscure vision more than 5 feet.			
Are ventilators in proper place?			
Is appropriate fire extinguishing and rescue equipment available?			
Have safety procedures been outlined and involved employees informed?			
Are employees wearing required personal protective equipment? Have they been medically evaluated to wear them?			
Is welding permit required? Is welding permit issued and posted with this permit?			
Is access adequate and clear?			
Is an attendant trained, available, and properly equipped (rescue/communications)?			
Is the confined space clean?			
Have arrangements been made for standby rescue personnel? Verification?			

ATMOSPHERIC MONITORING EQUIPMENT UTILIZED:			
Model	Serial Number	Date of Field Testing*	Date of Calibration**

*To be performed before testing a permit space.

** To be performed by manufacturer's representative.

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Sample Permit

ATMOSPHERIC TESTING RESULTS (Atmosphere to be retested after absence of entrants from a permit space.)				
Time	Oxygen %	Combustibles. % LFL	Carbon Monoxide, ppm	Hydrogen Sulfide, ppm

CIRCLE PERSONAL PROTECTIVE EQUIPMENT REQUIRED

<input type="checkbox"/> Supplied-air Respirator (Air-Line)	<input type="checkbox"/> Safety Alert System
<input type="checkbox"/> Hardhats	<input type="checkbox"/> Aprons
<input type="checkbox"/> Full Face Shield	<input type="checkbox"/> Air Purifying Respirator
<input type="checkbox"/> Powered Air Purifying Respirator (PAP)	<input type="checkbox"/> Self-contained Breathing Apparatus (SCBA)
<input type="checkbox"/> Safety Glasses/Goggles	<input type="checkbox"/> Impervious Boots/Pants/Jacket/Gloves
<input type="checkbox"/> Other _____	(Consult MSDS for compatibility)

CIRCLE RESCUE/EMERGENCY EQUIPMENT REQUIRED (Must have equipment available and in working condition at confined space entry area when required by the written plan or entry supervisory.) Mechanical device shall be available for vertical entry of more than five feet.

Tripod	Harnesses with Retrieval Lines*	Winch/chain or cable	Communication devices (specify method)
Other _____			

COMMENTS OR SPECIAL INSTRUCTIONS
 *Authorized entrant(s) shall use a body harness with retrieval line unless the entry supervisor can document safety hazards to the authorized entrants if a retrieval line is connected to a fixed point.

HAS COMMUNICATION BEEN ESTABLISHED BETWEEN AUTHORIZED ENTRANTS AND ATTENDANT?

YES NO If no or not required, please explain: _____

HAS COMMUNICATION BEEN ESTABLISHED BETWEEN ATTENDANT AND THE RESCUE AND EMERGENCY SERVICE? YES NO If no or not required, please explain: _____

ARE RESCUE SERVICES AVAILABLE? YES NO **LOCATION OF NEAREST PHONE:** _____

PHONE NUMBER: _____ **IS THERE A COPY OF THE MSDS(s) AT THE JOB SITE?** YES NO

PERMIT ISSUANCE/APPROVAL**

_____/_____/_____ DATE	_____:_____ TIME	_____ ENTRY SUPERVISOR'S SIGNATURE (Initial Permit)
_____/_____/_____ DATE	_____:_____ TIME	_____ EMPLOYEE(S) SUPERVISOR'S SIGNATURE
_____/_____/_____ DATE	_____:_____ TIME	_____ ENTRY SUPERVISOR'S SIGNATURE***

** Permit must be on file one year after it has been canceled. *** Atmosphere must be retested before permit is signed.

VERIFICATION AND CANCELLATION OF PERMIT

_____ ENTRY SUPERVISOR'S SIGNATURE	_____/_____/_____ Date
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Notes