
CONFINED SPACES

A. Purpose/ Scope:

This procedure establishes the minimum acceptable requirements for safe entry into a permit required confined space. This procedure applies to all employees who are required to enter a permit required confined space.

B. Responsibilities:

Department Management

- All departments must identify areas that meet the requirements of a permit required confined space. Upon identifying these spaces, the potential hazards must be assessed and the procedures written below must be followed.
- Responsible for providing the resources necessary to ensure compliance within their department with all requirements of this procedure.
- Responsible for ensuring that the requirements of this procedure are followed whenever entry into a permit required confined space is performed.

Authorized Entrant, Attendant, Entry Supervisor

- All employees whose work is regulated by this section are responsible for ensuring that the provisions of this procedure are followed while performing confined space entry operations.
- The entrant, attendant and entry supervisor shall successfully complete the City of Pittsburgh Confined Space Entry training program.
- The entry supervisor is responsible for ensuring that the entry permit is thoroughly and accurately completed prior to entry. The entry supervisor must sign the permit.

Safety Manager

- Will provide technical support and assistance on risk evaluation, monitoring, training, and personal protective equipment review and selection.
- Will provide assistance to departments in identifying permit required confined spaces and posting as required in this procedure.
- Responsible for providing the City of Pittsburgh Confined Space Entry training program.
- Responsible for auditing entry permits for deficiencies and recommending the proper corrective actions for noted deficiencies.

C. Definition of a Confined Space:

A space that:

1. Is large enough and so configured that an employee can bodily enter.
2. Has limited or restricted means for entry and exit.
3. Is not designed to be occupied for extended periods of time.

Examples of confined spaces include tanks, silos, storage bins, hoppers, vaults, pits, furnaces, tunnels, sewers, pipelines, crawl spaces, process vessels, or underground areas. Tasks performed in confined spaces include cleaning, painting, welding, scraping, repairs, and maintenance.

The first step in developing a confined space program is to determine if there are any confined spaces based on the characteristics listed above. Departments should conduct an assessment to determine if any confined spaces exist, and develop site specific procedures. If the confined space identified requires entry by an employee then a written program is needed. Post danger signs and educate employees on the hazards associated with the confined space and keep unauthorized employees out. Warning signs shall be posted on all entrances to permit required confined spaces. Signs marking permit required confined spaces shall include the following:

DANGER - CONFINED SPACE - ENTRY BY PERMIT ONLY

Definition of a Permit Required Confined Space:

A confined space becomes a permit required confined space if it presents or has the potential for any recognized serious hazard as follows:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing a person in the space.
- Has slanting walls or a sloped floor that tapers to a smaller cross section that could trap or asphyxiate the entrant.
- Contains any other recognized serious safety or health hazard.

D. Training:

No employee shall be assigned tasks requiring entry into a permit required confined space or tasks necessary to support confined space entry unless that employee has successfully completed a Confined Space Entry training course.

Training shall be conducted:

- before the employee is first assigned duties of an entrant, attendant, or entry supervisor;
- when there is a change in the assigned duties;
- when there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;
- When the entry supervisor, department management or Safety Office representative has reason to believe that there are deviations from the permit space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

All employees whose work is regulated by this section must be told which work areas are permit required and that entry into such work areas requires an entry permit. All employees whose work is regulated by this section must be trained on the recognition, evaluation and control of hazardous atmospheres in confined spaces. Training must also be provided on how to recognize the hazards that they may encounter, what to do when a hazardous situation arises and how to control the area to gain an acceptable entry condition.

Designated employees will be trained on how to use the monitoring equipment in order to recognize the difference between hazardous and acceptable atmospheres, and have proper training in the care of the equipment.

If necessary, designated employees may be trained on the proper use of a SCBA. Also training will be conducted on the use of communication equipment that may be used between attendants and entrants.

All employees whose work is regulated by this section will be trained on how to properly complete a confined space permit. All information on the permit will be explained so that the employee filling out the permit understands the purpose of the permit.

E. Rescue:

No person shall enter a confined space for rescue unless certified in confined space rescue and equipped with an SCBA and other necessary rescue equipment. Rescue procedures must be developed before hand in case of emergency. Multiple deaths have occurred in confined spaces when unprepared people try to rescue an entrant. When entrants must work in a space more than 5 feet deep, a fall protection and hoist system must be used in case rescue is needed. Each authorized entrant must wear a body harness and be connected to a decent device upon entry into a space 5 feet or more deep.

A supervisor from the department responsible for the entry will place the city's EMS Rescue team on alert of the entry. The city's EMS Rescue team has received all of the appropriate training for confined space entry rescue. Rescue persons must perform a practical exercise involving a rescue from a representative permit required confined space at least annually. All members of the rescue team must practice performing a rescue utilizing the equipment during this practical exercise. All rescue persons must be trained and qualified to perform first aid and CPR.

F. Hazardous Atmospheres:

- Oxygen Deficiency - The percentage of oxygen for entry into a permit required confined space shall be no less than 19.5% nor greater than 23.5%. If the percentage of oxygen is less than 19.5%, entry into a confined space shall be prohibited until ventilating techniques have increased the oxygen level to a minimum of 19.5%.
- Too Much Oxygen: - If tests indicate that the oxygen level is greater than 23.5%, hot work or work that may produce an ignition source are prohibited until ventilating techniques have reduced the oxygen level to no greater than 21%.
- Fire/Explosion hazard: - Smoking, welding, grinding or unapproved electrical equipment could ignite flammable gases in a confined space. Entry into a permit required confined space for any type of work shall be prohibited when tests indicate the concentration of flammable gases in the atmosphere is greater than 10% of the lower explosive limit. (**NOTE**: It is necessary to determine the oxygen level prior to testing the atmosphere for flammability to make necessary corrections in the flammability measurement)
- Toxicity: - Inhaling toxic substances above their exposure limits can cause illness, suffocation or even death. Entry into a permit required confined space for any type of work shall be prohibited when tests indicate the concentration of toxic material in the atmosphere is greater than the published IDLH (Immediately Dangerous to Life & Health) value.

G. Air Testing and Monitoring:

- Entry into a permit required confined space is prohibited until initial testing of the atmosphere has been performed from the outside and the space is safe for entry.
- The tests performed shall be those for **oxygen content, flammability and toxic atmospheres**. Additional tests will be selected and performed to the satisfaction of the authorized person. Frequency of the monitoring shall be determined by the authorized person based on monitoring results, hazards present and operations being performed. Continuous monitoring must be performed if a hazardous atmosphere is detected.

- **Erroneous readings may result if an oxygen deficient condition exists. You must ventilate the area to increase oxygen content.**
- Monitoring of the atmosphere shall be performed in accordance with the permit. Equipment for continuous monitoring of gases and vapors shall be equipped with an audible alarm that will alert employees when a hazardous condition develops.
- Instruments shall be calibrated in accordance with the manufacturer's guidelines and documented on the permit.
- Monitoring must be throughout the entire depth of the confined space. Documentation must reflect testing of at least 4-foot intervals, to ensure that the space does not contain "pockets" of contamination or oxygen deficiency.
- If any detectable concentrations of flammable vapors are present, all electrical equipment shall comply with the requirements of the NEC article 500 (Hazardous Locations).
- Initial testing of the atmosphere must be performed from the outside of the permit required confined space before ventilation begins to determine what precautions are necessary in purging and ventilating. Testing of remote regions within the space can be performed by the use of probes specifically designed for the equipment.
- Where continuous ventilation is not a part of the operating procedure, the atmosphere shall be tested until continuous acceptable levels of oxygen and contaminants are maintained for three tests at 5-minute intervals.

H. Safety Equipment and Clothing:

- The specific personal protective equipment to be used in the permit required confined space must be identified, selected and documented on the entry permit prior to entry.
- Safety equipment that is required to extract an entrant from a permit required confined space include:
 - ⇒ For all entries: a full body harness with "D" rings and an attached lifeline shall be worn at all times. If the exit opening is less than 18 inches (45 cm) in diameter, then a wrist type harness shall be used in addition to the full body harness.
 - ⇒ When performing a vertical entry greater than 5 feet in depth, mechanical means shall be provided for extraction.
 - ⇒ Personal fall arrest systems shall be provided whenever employees are required to work on elevated areas (4 feet or higher) above ground or grade level when other fall protection devices are impractical.

I. Permits:

- Entry permits shall be completed prior to each entry into a permit required confined space.
- ***All items on the permit must be addressed and all deficiencies must be corrected prior to entry.***
- The signature of the entry supervisor indicates that the issues identified on the permit have been addressed and corrected if necessary.
- Entry permits shall be canceled by the entry supervisor at the completion of the operation, after each shift, or in the event of a city wide emergency that would impair the response of the rescue team.
- Entry permits shall be canceled by writing the word "canceled" on the first page of the permit. The permit may only be canceled after the space has been properly closed off or otherwise secured.

- Canceled permits shall be forwarded to the Safety Office, Room 431 – City County Building, within 48 hours of the operation.
- A safety program representative will evaluate the canceled permits for compliance to standards and procedures. All deficiencies noted shall be corrected prior to subsequent entries.

J. Work Practices:

Before entering a permit required confined space, all employees involved in the task shall participate in a safety briefing. The authorized employee assigned as entry supervisor shall conduct this briefing and review the following:

- Specific requirements for safe entry.
- Location of the nearest first aid equipment.
- Location of the nearest telephone.
- Location of the nearest emergency exit.
- Individual responsibilities.
- All hazards associated with entry.
- Acceptable entry conditions (which include):
 - ⇒ Atmospheres containing between 19.5 - 23.5% oxygen.
 - ⇒ Atmospheres less than 10% of the lower explosive limit (LEL).
 - ⇒ Atmospheres containing toxic materials at levels below published exposure limits.

NOTE: The existence of the following conditions will prevent routine confined space entry:

- **Entry into an atmosphere Immediately Dangerous to Life or Health (IDLH).**
- **Entry into an atmosphere > 10% of the lower explosive limit (LEL).**
- **Entry into an atmosphere which contains < 19.5% oxygen or > 23.5% oxygen.**
- **Entry into an atmosphere that contains exposure to a known carcinogen in excess of accepted health and safety standards.**

These prohibitions to confined space entry are not permitted to be circumvented unless:

- Notification of the condition is provided to the Safety Manager.
- The scope of the job or task and the necessity to enter is provided to and reviewed by the Safety Manager.
- Approval for entry is given by the Safety Manager concurrent with the entry supervisor's agreement to follow the procedures specified for safe entry and subsequent work.

Duties of the Authorized Entrant:

- Know the hazards that may be faced during entry, including signs or symptoms and consequences of the exposure.
- Properly use protective equipment to maintain safe working conditions.
- Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrant of the need to evacuate the space, if necessary.
- Alert the attendant if any warning sign or symptom of exposure to a dangerous situation is recognized, or when a prohibited condition is detected.
- Exit from the permit space as quickly as possible if: (1) an order to evacuate is given by the attendant or entry supervisor, (2) the entrant recognizes a warning of a dangerous situation, (4) detects a prohibited condition or (5) the evacuation alarm on the monitoring equipment is activated.

Duties of the Attendant:

- Know the hazards that may be faced during entry, including signs or symptoms and consequences of the exposure.
- Be aware of the possible behavioral effects of hazard exposure to authorized entrants.
- Continuously maintain an accurate count of authorized entrants in the space.
- Remain outside the entry space until relieved by another attendant or the work is completed.
- Communicate with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space.
- Monitor activities inside and outside of the space to determine if it is safe for entrants to remain. Order the entrants to evacuate the space under any of the following conditions: if the attendant detects a prohibited condition, if the attendant detects any behavioral effects in the entrant.
- Summon rescue and other emergency personnel as soon as the attendant determines that the authorized entrant needs additional assistance to escape from the confined space.
- Warn the unauthorized person that they must stay away from the permit space; advise the person that they must exit immediately if they have entered the space inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

Duties of the Entry Supervisor:

- Know the hazards that may be faced during entry, including signs or symptoms and consequences of the exposure.
- Verify 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 necessary equipment specified by the permit are in place before endorsing the permit and allowing the work to begin.
- Verify that all entrants and attendants are knowledgeable of their duties and responsibilities to perform the entry in accordance with this procedure.
- Terminate the entry and cancel the permit when the work on the permit is completed or if a situation arises that is dangerous to the authorized entrant(s).
- Verify that the rescue services are available and that the means for summoning them are operable.

K. Ventilation:

- Atmospheric testing and continuous ventilation must be conducted to ensure the presence and continuance of a safe atmosphere for entrants.
- Ventilation and/or purging may be required prior to entry, during the work being conducted and possibly after the work has been completed.
- Ventilation should be used continuously during entry unless continuous ventilation could increase the risk to the entrants. The method used and frequency of testing must be determined by the entry supervisor based on the results of atmospheric testing, the potential or existing hazards, the work being performed and the internal design of the space.
- During ventilation and/or purging the blower controls, as well as all other ignition sources, must be at a safe distance from the contaminated air if flammable atmospheres are a potential.
- Atmospheric tests shall be made as often as necessary to ensure that a safe atmospheric level is maintained.

- General ventilation may be used (with caution) for distributing contaminants from a local generation point throughout the workspace for maximum dilution. However, special precautions shall be taken to include a method for providing respirable air to each worker in the space.
- Local exhaust ventilation shall be provided when general ventilation is not effective due to restrictions in the confined space or when high concentrations of contaminants occur in the breathing zone of the workers from a single emission source (welding, painting, cleaning, etc).
- Exhaust systems must be positioned in such a manner to protect workers in the surrounding area from contaminated air and/or to prevent a flammable atmosphere from coming in contact with an ignition source.
- If a space contains a flammable atmosphere above 10% of the LEL (Lower Explosive Limit), the space shall be purged with an inert gas prior to ventilation. Air monitoring must be performed outside of the space during purging to ensure that unacceptable levels of contamination are not present as a result of the displacement.

NOTE: Respiratory protection may be needed, in addition to ventilation controls, based on air monitoring analysis.

L. Energy Isolation:

Energy isolation and lockout/tagout procedures will be specific for each permit required confined space entry. The permit required confined space will be completely isolated from all other systems by using one of the following techniques:

- Physical disconnection.
- Blanking off all lines.
- By double block and bleed.

Blanks used to seal off lines shall:

- Be capable of withstanding the maximum working pressure or load of the line (with a minimum safety factor of 4).
- Be provided with a gasket on the pressure side to ensure a leak proof seal if evidence of leaking is present, and be made of a chemically compatible material.
- In addition to blanking, pumps and compressors serving these lines shall be locked out to prevent accidental activation.
- Mechanical isolation of moving parts must be achieved by utilizing a method that will eliminate inadvertent or unexpected activation. Such methods may include disconnecting linkages or removing drive belts or chains.
- Other forms of stored energy (e.g. hydraulic, pneumatic) must also be bled or otherwise isolated to prevent accidental release.
- Shutoff valves serving the permit required confined space shall be locked in the closed position and tagged for identification using the City of Pittsburgh procedure for the Control of Hazardous Energy (Lockout/Tagout).

M. Cleaning Activities:

Procedures and processes used to clean the inside of a permit required confined space shall be reviewed and authorized by the entry supervisor. **All chemicals used in a confined space must be approved by a Safety Program representative and local exhaust ventilation must be used if the agent will contribute to or cause hazardous atmospheric contamination.** Initial cleaning shall be performed from outside of the confined space if at all possible.

N. Tools and Equipment:

Equipment and tools to be used in a confined space shall be inspected and meet the following requirements:

- Portable electric tools, equipment, and lighting shall be equipped with a ground fault circuit interrupter (GFCI).
- All electrical cords, tools and equipment shall be of heavy duty type construction and inspected for visually detectable defects before use in a confined space.
- All lighting and equipment, used in permit required confined spaces where flammable liquids / gases are present, shall be of explosion proof design (NEC - Article 500). It shall also be approved by Underwriter's Laboratories, (Class 1, Division 1 or Class 1, Division 2), for use in the presence of flammable or potentially flammable atmospheres and, where necessary, be equipped with guards.
- Electric cords shall not hang lighting, unless specifically designed for that purpose. The illumination of the work area shall be sufficient to provide safe work conditions. **Under no circumstances will matches or open flames be used for permit required confined space illumination.**
- Cylinders of compressed gases shall not be taken into confined spaces. Exempt from this rule are cylinders that are part of self-contained breathing apparatus, emergency egress bottles, or resuscitation equipment. Only hose lines and components designed specifically for compressed gas and working pressure shall be used. Such systems shall have a pressure relief valve located outside of the confined space.
- Ladders shall be adequately secured or of a permanent type.
- Scaffolding and staging shall be properly designed to carry maximum expected load (safety factor of 4), shall be equipped with traction type planking, and meet the requirements of 29 CFR 1910.28.
- Communications equipment and/or strategies shall be provided to ensure effective, continuous communication between the entrant and the attendant.
- Barriers shall be provided to ensure protection of the entrant from external hazards.

O. Contractor Work:

City employees contracting out permit required confined space work must ensure that contractors are qualified through training and adhere to the provisions of this procedure or use their own equally effective procedure. Specifically, the city employee contracting the work must:

- Ensure that the contractors follow the provisions of this procedure.
- Inform the contractor that the workplace contains permit spaces and that entry into permit spaces is allowed only through compliance with this procedure.
- Apprise the contractor of the elements, including the hazards identified in the space.
- Apprise the contractor of any precautions that have been implemented for the protection of individuals in or near permit spaces where contract personnel will be working.
- Coordinate entry operations with the contractor when both City and contractor personnel will be working in or near permit spaces.
- Debrief the contractor at the conclusion of entry operations regarding specific hazards confronted during the entire operation.
- Review the specific entry procedure, the equipment/supplies to be used, and the work to be completed with the Safety Manager. Procedures and equipment / supplies must be approved by the Safety Manager prior to entry.

**CITY OF PITTSBURGH
 CONFINED SPACE ENTRY PERMIT**

GENERAL INFORMATION

Space to be entered:	Date:
Permit valid from (date & time) :	Permit valid to (date & time)*
Job Location:	
Purpose of the entry:	
Describe Material in Confined Space:	
Work Planned:	

*No longer than 8 hours

CHECKLIST

Item	yes	n/a	Comments
All gas/liquid lines isolated			
Electrical/pneumatic/hydraulic systems locked-out			
Grounding/bonding cables in place			
Has exposure to toxic materials been identified*			
Ground fault interrupters operational			
Equipment approved for explosive atmosphere			
Ignition sources removed/isolated			
Will hot work be performed and has a hot work permit been completed			
Respiratory equipment and breathing supply operational			
Protective clothing identified and in use			
Safety harnesses/lifelines operational			
Fire suppression equipment available			
Rescue breathing supply available			
Ventilation equipment in use (all entries)			
Special warning/caution signs in use			
Communications available - describe method used			

*specify substances

TESTING RECORD

	Acceptable	results/ time	results/ time	results/ time	results/ time	results/ time
Oxygen level	19.5 - 23%					
Flammability	<10% lel/fl					
H ₂ s	<10 ppm					
CO	<35 ppm					
Other *	*					
Initials of tester						
Time of test		am pm				

*specify

CONFINED SPACE ENTRY PERMIT

RESPIRATORY EQUIPMENT

	SCBA (available for all entries)		fully encapsulating suit +
	air line with egress bottle		chemical protective suit +
	full face air-purifying*		work uniform
	half face air purifying*		

*specify cartridge type +specify type - Check Permeation Rates & monitor contact time

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

	chemical splash goggles		hard hat
	face shield		gloves +
	safety glasses		disposable foot coverings +
			steel toed/steel shank safety boots

+specify type - Check Permeation Rates & monitor contact time

EXTREMITY PROTECTION

OTHER PROTECTION

	hearing protection		fire extinguisher #
	full body harness (for all entries)		SCBA #
	life line (for all entries)		mechanical extraction +
	communication aids(for all entries)+		first aid supplies #

+specify type #specify location

EMERGENCY AND RESCUE EQUIPMENT

EMERGENCY SERVICES

Agency	Internal #	External #
Police	911	911
Fire	911	911
Hospital	911	
EMS	911	
Safety Office	2403, 2383	412-590-4323 pager
General Services	2330	

Location of nearest telephone	
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PERSONNEL ASSIGNED

Name	Signature	Duties
		Entry leader
		Attendant
		Entrant

Signature indicates that all of the information listed above is accurate and the space is safe for entry

Issued by :	Signature:	Date:
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CITY OF PITTSBURGH
THIS PERMIT IS VALID FOR 8 HOURS ONLY