

# Confined Space Program

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University of Wisconsin-Milwaukee

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## CONFINED SPACE PROGRAM

This standard establishes the minimum requirements when it is required that persons enter UW-Milwaukee Permit Required Confined Spaces such as tanks, tunnels, pits, ducts, chambers or utility manholes.

A safe campus environment shall be provided for all UW-Milwaukee employees, students, guests and residents of the community. This written program complies with the OSHA's Confined Space Standard 29 CFR 1910.146 and the Wisconsin Administrative Code Comm 32.29. This program is intended to protect workers from toxic, explosive, or asphyxiating atmospheres and from possible engulfment. All requirements specified in this program will apply to all UWM employees working under the direct supervision of UWM. When engineering or administrative controls will not provide an acceptable level of protection, PPE will be provided to achieve safe working conditions.

All personnel who are a part of an entry team have certain responsibilities as members. All practices established by this standard are expected to be retained and demonstrated by each member of the entry team. Evaluation of confined space entry program compliance and associated recordkeeping will be completed annually by the University Safety and Emergency Management Officer.

## DEFINITIONS

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

Attendant: An individual, who is stationed outside of a permit-required confined space, monitors the authorized entrants, performs other duties for the work, and has the authority to cancel the permit if necessary and when the work is complete.

Authorized Entrant: Employee who is authorized by UWM to enter a permit required space.

Blanking or blinding: absolute closer of a pipe, line, or duct by the fastening of a solid plate 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.

Confined Space: an area that which:

1. Has adequate size and configuration for employee entry;
2. Has limited means of access or egress; and
3. Is not designed for continuous employee occupancy.

Double Block and Bleed: The closure of a line, duct, or pipe by closing and LOTO two in-line valves and b opening and LOTO a drain or vent valve in the line between the two closed valves.

Engulfment: surrounding and effective capture of a person by a liquid or finely divided solid substance.

Entry Permit: Written or printed document provided by UW-Milwaukee to allow and control entry into a permit space. This document must be returned to the campus Risk Manager after expiration of the permit.

Entry Supervisor: This person is responsible for:

1. Determining if acceptable conditions are present before entering a permit space;
2. For authorizing entry;
3. Overseeing entry operations; and
4. Terminating entry

Hazardous Atmosphere: an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness.

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

Immediately Dangerous to Life or Health (IDLH): 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: 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.

Isolation: process by which a permit space is removed from service and completely protected against the release of hazardous energy or material into the space.

Line Breaking: 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.

Lower Explosive Limit (LEL): the lowest concentration of gas or vapor; expressed in percent by volume in air that burns or explodes if an ignition source is present at room temperature.

Non-permit confined space: 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 serious physical harm.

Oxygen deficient atmosphere: An atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere: An atmosphere containing more than 23.5 percent oxygen by volume.

Permissible Exposure Limit (PEL): the airborne concentration of a hazardous material that must not be exceeded over a specified time or instantaneously. This value is established by OSHA.

Permit-Required Confined Space: a confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration that can trap or asphyxiate an entrant 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

Prohibited condition: Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue Service: personnel designated to rescue employees from permit spaces, from now on to mean the City of Milwaukee Fire Department's Heavy Urban Rescue Team.

Retrieval System: equipment used for a non-entry rescue of persons from permit spaces.

Testing: 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.

### **POLICY AND RESPONSIBILITY**

All personnel who are a part of an entry team have certain responsibilities as members. All practices established by this standard are expected to be retained and demonstrated by each member of the entry team.

### **CONFINED SPACE ENTRY PROGRAM**

The confined space entry program consists of procedures to communicate the program requirements to all UW-Milwaukee employees. The program consists of the following:

- Confined space entry requirements
- Confined space entry permit
- Confined space procedures and techniques
- Training requirements for entry personnel

- Confined space rescue procedures

## **PERSONNEL REQUIREMENTS AND RESPONSIBILITIES**

### Attendant:

- Know and recognize hazards that may be faced during entry.
- Be aware of behavioral effects of exposure to hazardous atmospheres
- Maintain accurate counts and means to identify all entrants.
- Remain outside the space unless relieved by another qualified attendant
- Monitor activities inside and outside space.
- Monitor status of entrants and initiate evacuation if: 1) unsafe conditions are detected; 2) present situation may endanger the entrant; or 3) attendant cannot effectively and safely perform duties
- Know proper method of summoning rescue service before entry.
- Summon rescue services if needed.
- Establish and maintain a means of communication, via voice, radio or telephone.
- Keep unauthorized persons out of entry space.
- Perform non-entry vertical rescues using a winch.
- Perform no other duties that may distract from the primary duties.

### Authorized Entrant:

- Know and recognize hazards that may be faced during entry.
- Obtain and properly use necessary personal protective equipment.
- Communicate as necessary with the attendant.
- Alert attendant when hazardous conditions are detected, identified or suspected.
- Exit the space immediately whenever: 1) ordered to do so by other members of the entry team; 2) warning signs/symptoms are identified; 3) prohibited conditions are identified; or 4) evacuation alarm is activated.

### Entry Supervisor:

- Know and recognize hazards that may be faced during entry.
- Verify that all entries have been made on the permit.
- Verify that tests are completed and procedures and equipment are in place.
- Authorize entry to begin.
- Sign permit prior to entry.
- Cancel permit when job is complete or unacceptable conditions arise.
- Know proper method of summoning rescue services before entry.

- Ensure that responsibilities are safely and effectively transferred
- Ensure entrants have all necessary personal protective equipment.

## **EVALUATION OF THE HAZARDS**

Before granting entry, the entry supervisor should be aware of the following possible hazards specific to a particular permit-required confined space. Possible hazards that employees could be exposed to in a confined space are:

1. Flammable gases, vapors or mists;
2. Air-borne combustibles such as dusts;
3. Hazardous chemicals above the Permissible Exposure Levels (PELs);
4. Toxic substances commonly encountered are:
  - a. Carbon monoxide, a colorless odorless gas created by internal combustion. It can kill by decreasing the capability of the blood to carry oxygen.
  - b. Hydrogen sulfide is a toxic gas that quickly deadens the sense of smell.
5. Oxygen concentrations pose dangers if outside a narrow range:
  - a. An oxygen deficient atmosphere contains less than 19.5% oxygen. This may not be enough oxygen to supply the employee's respiratory needs when performing physical work. Atmospheres at 19.5% and lower are immediately dangerous to life and health.
  - b. Oxygen levels above 23.5% have the potential to be an explosive atmosphere or accelerate combustion.
  - c. Oxygen deficiencies could be caused by:
    - i. Fire or explosion;
    - ii. Displacement of oxygen by other materials such as methane, produced by rotting organic matter, or carbon dioxide produced by fermentation;
    - iii. Corrosion or rust
6. Other hazards may include:
  - a. Engulfment caused by finely divided, flowable solids such as grain or coal that can collapse around a person filling or plugging the respiratory system or cause death by strangulation, constriction or crushing;
  - b. Poor space design. Odd shapes such as sloping sides, floors that taper to small sections, or confusing internal shapes could cause a person to become trapped and possibly cause suffocation;
  - c. Combustion due to fire or explosion caused by build-up of flammable vapors, gases, or dusts which can be ignited by grinding, welding, unapproved electrical equipment, metal friction, smoking or static electricity, poor ventilation;
  - d. Heat can build up quickly in a confined space and cause exhaustion or heat stroke;
  - e. Falls and slips in a confined space can be fatal. A person can be trapped in an area with low oxygen levels or toxic gases. Rungs, railing, and walking surfaces in damp environments are dangerous; shallow water depths could cause drowning;

- f. Noise reverberates in a confined space; workers may not be able to hear important directions or warnings. Over time, permanent hearing problems could develop;
- g. Mechanical hazards pose special problems in confined spaces; valves and pipes not disabled may explode, moving parts are dangerous; equipment must be locked out/tagged out before entering.

### **ATMOSPHERIC REQUIREMENTS PRIOR TO ENTRY**

Before entering, the following atmospheric conditions must be met:

- Oxygen level (must be between 19.5% and 23.5%)
- Flammable gas, vapor, or mist (below 10% of the lower explosive limit).
- Hydrogen sulfide (below 10ppm)
- Other toxic gas levels.

Entry into a permit-required space will not be allowed if monitoring indicates deficiency in any of these categories.

### **ENTRY AND EXIT**

The extent of entry and exit precautions needed to maintain a safe confined space work area must be determined for each confined space entry location. All necessary entry and exit equipment shall be identified on the applicable permit. The following items shall be evaluated and considered:

- Type of confined space to be entered
- Barriers within the space
- The occupancy load of the space
- Time required for emergency exiting

### **CONFINED SPACE PERMIT PROCEDURES**

Confined space entry permits are required for entering any confined space. To obtain a permit, the entry supervisor must first confirm that work cannot be accomplished without entering the space. If work requires entry, a permit will be completed by the entry supervisor and the Safety Director.

The entry supervisor must make all determinations regarding the safe entry into the space. The entry supervisor, following all requirements will grant or refuse entry into the space after reviewing the monitoring the results.

If entry is granted, the completed permit will be posted or otherwise made readily accessible to all authorized entrants. All authorized entrants will review the permit, review rescue procedures, and don any personal protective equipment before entering the space. The entry team will contact UWM Police Department before entering the space.

Permits are only valid up to eight (8) hours. Some exceptions may be granted with specific approval from University Safety and Assurances.

The entry supervisor is required to terminate an entry or cancel the permit when the job is complete or a prohibited condition arises in the work area. Upon termination/cancellation, UWM Police Department must be notified that the entry team(s) has emerged from the space. The permit can then be scanned and emailed or delivered to the University Safety and Assurances. All permits will be uploaded into the TWA System ~~retained for 1 year~~.

## **HAZARD CONTROL**

### *Lockout and Tagout*

If activation of electrical or mechanical equipment would cause injury to confined space entrants, then the equipment shall be removed from service and stored energy must be released to prevent inadvertent activation before workers enter the confined space. Any stored energy must be verified in a zero state before work can begin.

All confined spaces shall be completely isolated from other systems such as feed lines for liquids, solids or gases, by physically disconnecting, double-blocking and bleeding, or blanking off all feed lines. In a continuous system where complete isolation is impossible, such as sewers, specific procedures for isolation shall be prepared and followed. Shut off valves servicing the confined space shall be locked in the closed position and tagged for identification.

## **LABELING REQUIREMENTS**

Where possible, each permit-required confined space should be labeled indicating that special precautions must be taken prior to entering the space. The signage for each space will read:

**DANGER**  
**Confined Space**  
**Enter by Permit Only**

Some variation will be allowed as long as the general message is clearly conveyed.

### ***Time required for emergency rescue.***

At minimum, all confined spaces deeper than 4 feet or the employee's shoulder height (whichever is less) shall be required to have a ladder securely fixed within the space. This ladder shall not be removed until all employees have exited the space.



## **EQUIPMENT AND TOOLS**

Confined space entry shall be allowed only when all equipment necessary for a safe entry has been assembled and shown to be in proper working order. Equipment that may be necessary includes:

- (1) Atmospheric testing equipment (worn by entrant and continuous monitoring via probe from the top of the confined space)
- (2) PPE
  - a. Hardhat
  - b. Safety glasses
  - c. Work gloves
  - d. Tyvek suit if applicable
- (3) Communication devices, and
- (4) Entry and exit and rescue equipment.
  - a. Harness with tripod

All equipment and tools to be used within a confined space shall be inspected and meet the following requirements:

- Hand tools shall be kept clean and in good repair and selected according to intended use.
- If portable electrical tools and equipment are used, they shall be equipped with a ground fault circuit interrupter and checked before use within a confined space.
- All electrical cords, tools, and equipment shall be of heavy-duty type with heavy-duty insulation and inspected for visual defects prior to use.
- All equipment that may be used in a flammable atmosphere shall be explosion-proof or intrinsically safe for the atmosphere involved
- Lighting used within a confined space shall be of explosion-proof design and equipped with guards. Lighting must be listed by the Underwriters Laboratories for use in Division 1 atmosphere of the appropriate class and group, or be approved by the U.S. Bureau of Mines, the Mine Safety and Health Administration, or the U.S. Coast Guard.
- Lighting shall not be hung by electrical cords unless specifically designed for that purpose. The illumination of the area shall be sufficient to provide for safe work conditions.
- Cylinders of compressed gases shall never be taken into a confined space. When not in use, cylinders shall be turned off at the cylinder valve and capped. This restriction does not apply to self-contained breathing apparatuses or resuscitation equipment.
- Any hot work (such as welding, burning, or use of open flame) must follow guidelines.

## **MONITORING**

Prior to entry into each confined space a sample for the following atmospheric conditions in the listed order:

- Oxygen level (must be between 19.5% and 23.5%)

- Lower explosive limit (cannot exceed 10%).
- Hydrogen sulfide (cannot exceed 10ppm)
- Other toxic gas levels.

The entrant will be **wearing a monitor at all times**. There will also be continuous monitoring from the outside of the confined space via a probe.

## **COMMUNICATION**

Each entry team is required to establish and maintain communication with its members during the course of work. In instances where distance or surrounding noises prohibit visual or audible communication, 2-way radios will be used. Radio or telephone communication must be readily available to the attendant for emergencies. The attendant is responsible for establishing and maintaining a means of communication, via radio, telephone, or cellular telephone. Signs will be situated outside of the confined space indicating a worker is in the confined space to warn others not a part of the team.

## **AUTHORIZATION FOR ENTRY**

Prior to entry, the entry team is required to notify UWM Police Department as to the location, time of entry, and number of personnel entering the permit-required space. The entry team must notify UWM Police Department when entry activities are complete. If the entry team will be intending to enter more than 1 confined space, they must notify UWM Police Department or dispatch prior to entry into each confined space.

## **TRAINING**

Training shall be provided to all UWM Facilities Management employees personnel entering confined spaces. Supervisors tasked with overseeing projects shall verify that all University personnel have received training and are proficient and certified in their duties as required by this program.

Employees actually entering confined spaces must have the training described below for non-permit required and permit-required confined spaces before entry and must be briefed on site-specific hazards while on site.

### Non-Permit Required Confined Space Training

UWM personnel performing non-permit required confined space entry shall receive training in the following:

- Definition of confined spaces
- Recognition, evaluation, and control of chemical and physical hazards within a confined space

- Requirements of the confined space standard and the UWM confined space entry program
- Use and limitations of atmospheric testing and PPE

#### Permit-Required Confined Space Training

As a policy, UWM employees shall not enter permit-required confined spaces. However, should special circumstances require such work, UWM employees involved in the permit-required confined space entries shall receive training as necessary to safely perform the following assigned duties:

- *Authorized Entrant*-shall be trained and knowledgeable in the following:
  - The hazards of confined space entry, including being able to recognize the signs, symptoms, and consequences of the hazard exposure
  - Know how to use needed equipment
  - Communication with attendants as necessary and be able to alert attendants to the warning signs or the existence of a hazardous condition
  - Exit as quickly as possible whenever ordered or alerted to do so
- *Authorized Attendants*-shall be trained and knowledgeable in the following:
  - The hazards of confined spaces and how to monitor confined space conditions to determine if it is safe for entrants to remain in the space
  - The behavioral effects of potential exposures
  - Maintain continuous count and identification of personnel in the permit space
  - Remain outside the space until relieved
  - Communicate with entrants as necessary to monitor entrant status
  - May not perform other duties that would interfere with their primary duty to monitor and protect the safety of authorized entrants.
  - Monitor activities inside and outside the permit space and order evacuation if required
  - Summon rescuers if necessary
  - Prevent unauthorized entry into permit space
  - Perform non entry rescue if required
  - The reasons to order an evacuation, such as (1) observing conditions not allowed on the permit, (2) observing dangerous situations outside the space, (3) observing behavioral effects in authorized entrants, and (4) if the attendant must leave the work station or cannot safely perform his or her duties.
- *Authorized Supervisor*
  - Issues the confined space permit
  - Must know the hazards of the confined space.
  - Verify that all tests have been conducted and all procedures and equipment are in place before endorsing a permit, terminate entry if necessary, cancel permits, and

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

- Remove unauthorized individuals who enter the confined space
- Determine if shifts and entry supervisors change, that acceptable conditions, as specified in the permit, continue.

### **CONTRACTOR COORDINATION**

All turnkey contract jobs requiring confined space entry will require submittal of the contractor's confined space safety program and entry plan before the commencement of work. All regulatory requirements of 1910.146 "Permit-Required Confined Spaces" will be followed by the contractor. The contractor must furnish all equipment required for entry.

In instances where both UW-Milwaukee employees and contractors are serving as entrants, UW-Milwaukee will perform all duties prior to entry. In addition, UW-Milwaukee will furnish communication equipment and personnel to serve as attendant and entry supervisor.

### **CONFINED SPACE RESCUE AND EMERGENICES**

Even with the best efforts to review and assess the potential hazards of a confined space entry, the potential for something to go wrong may still exist, such as unexpected events or individual medical conditions. Having a plan for emergencies prior to entry can save valuable time should an emergency occur. Confined space rescue pre-planning for departments who enter confined spaces on a regular basis is on-going, and coordinated by University Safety and Assurances with the department and emergency responders (police, fire, and/or rescue). Considerations include:

- Having a means of calling 911 and UWM PD on site.
- Properly reporting the emergency to the 911 and UWM PD center so that emergency responders can arrive quickly and prepared.
  - Identify the emergency as involving a "confined space".
  - Provide the 911 address (street and building number). Give the nearest street and/or building if the space is not directly located at the address.
  - For remote spaces, such as high-voltage electrical vaults, provide the ELMH number of the vault.
- Implementing one of the rescue protocols below, as predetermined prior to entry.

### **Hierarchy of Rescue**

In the event that a confined space emergency occurs, regardless of the nature (entrant medical condition or a hazard with the space itself), the space reverts back to a permit-required confined space, and it must be reassessed prior to entry or re-entry.

### **Self Rescue**

In the event that something goes wrong in a confined space, self-rescue would be the ideal response. Self-rescue is where the entrant recognizes a problem early on, before it gets to a serious or IDLH level. Problems could be inherent to the confined space, external events that adversely affect the space, or personal health/medical issues of an entrant. Regardless of the source, exiting the confined space on ones own at early warning signs is the best option.

Examples include:

- Responding to air monitoring alarms as soon as they sound by exiting the space immediately,
- Recognizing early warning signs and symptoms of **oxygen deficiency, oxygen enrichment, carbon monoxide and hydrogen sulfide** exposure where continuous air monitoring is not required,
- Being aware of personal health concerns that are deteriorating and need to be addressed.

At the first sign of trouble, the entrants leave the space, get fresh air, and proper medical attention (if indicated). The space reverts back to permit-required until it has been reassessed and any hazards with the space have been effectively eliminated or controlled.

### **Non-Entry Rescue**

Where non-entry rescue protocols have been implemented for vertical entry spaces, the attendant shall immediately notify emergency services by calling 911. Once the call has been made, the attendant may begin rescue procedures. Under no circumstances may the attendant enter the confined space. Retrieval systems (e.g. tripod, winch, harness or wristlets, and lifeline) shall be used for entry when a vertical permit-required entry is made, unless such equipment increases the overall risk of entry, or the equipment would not contribute to the rescue of the entrant.

### **Entry Rescue - Non-Permit-Required**

Where self-rescue or non-entry rescue means and methods are not possible, the space must be reassessed prior to proceeding with entry rescue. Provided that all hazards have been eliminated or isolated, and the event is determined to be an individual medical emergency (ex. heart attack, diabetic emergency, heat stress), trained personnel may enter the non-permit-

required space. Extrication of the patient shall be coordinated with UWM Police and Professional First Responders.

### **Entry Rescue - Permit-Required**

If the space cannot be reclassified during the reassessment, rescue services shall be provided by UWM Police Department and Professional First Responders. **UWM personnel shall not enter a permit-required confined space for rescue purposes.** Known hazardous conditions shall be communicated to emergency responders during call and any changes upon arrival. Departmental efforts should be focused on cooperating with responding agencies to expedite rescue efforts, and/or providing support in the form of space access and expertise, available equipment, validation of controls, crowd control, etc.

### **ANNUAL REVIEW of Confined Spaces**

The UW-Milwaukee Confined Space Entry Program will be reviewed annually to determine its effectiveness. Utilizing canceled permits and other available information the safety department will determine if:

- Additional hazards have been identified within a given space;
- Additional measures should be taken to protect the entrants;
- Additional spaces should be included within the program and
- Some locations can be removed from the program

Appendix A: Confined space permit