

University of  
Arkansas  
Office of  
Environmental  
Health and Safety

# Confined Space Entry Program



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**University of Arkansas**  
**Office of Environmental Health and Safety**

**Procedure Name: Confined Space Entry Program**

**Procedure Number: 600.10**

**Effective Date: 3-1-2016**

**Procedure:**

This document establishes the University of Arkansas's Confined Space Entry Program. It is designed to provide for the identification, evaluation, and control of confined space hazards, and ensure that employees and contractors who must enter such locations are trained and apprised of the program. This procedure addresses the requirements of the Occupational Safety and Health Administration (OSHA) Confined Space Standard, 1910.146.

**Purpose:**

The purpose of the University of Arkansas's Confined Space Entry Program is to set procedures that will ensure workers safe entry in confined spaces and permit-required confined spaces to perform routine tasks associated with their employment. The procedure will also address the importance of proper documentation and record keeping associated with confined space entry.

**Definitions:**

**Confined Spaces** are locations that meet all three of the following criteria:

- Large enough for a person to fully enter and perform work.
- Not designed for continuous occupancy.
- Possess a restricted means of entry or exit.

Common examples of confined spaces at the University of Arkansas include tanks, vaults, manholes, boilers, tunnels, sewer and sump pits, large HVAC equipment, pipe chases and some crawlspaces and ductwork interiors.

**Permit-Required Confined Spaces** are confined spaces that possess potential hazards that could result in serious injury or death and are therefore subject to all the provisions of this program before entry is allowed. A confined space that contains one or more of the following characteristics is considered a Permit- Required Confined Space.

- Contains or could contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an 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 smaller cross section.
- Contains any other recognized serious safety or health hazard.

These spaces require a written permit prior to entry. The process of generating the permit forces supervisors, entrants, and attendants to work together and carefully consider the potential hazards associated with the space in advance, and prepare controls appropriate to space and entry work activities.

**Alternate Entry Procedures** are confined space entry procedures that can be used in place of a permit-required entry. These procedures may be adopted if:

- The only hazard in the confined space is an actual or potential hazardous atmosphere, and
- Forced air ventilation alone can maintain a safe atmosphere during entry.

**Underground Utility Installations** are another specific grouping of confined spaces that can be entered using procedures that are less stringent than those reserved for permit-required confined spaces. These installations are typically below grade vaults and are generally considered as permit-required confined spaces until pre-entry procedures are completed and the space has been determined to be safe for entry.

### **Individuals Covered by this Program:**

Employees whose job duties involve one or more of the following activities are included:

- Perform actual entries into permit-required confined spaces (Authorized Entrants);
- Serve as an attendants during permit-required confined space entry (Attendant);or
- Supervise others who enter or attend during entries (Entry Supervisor).

No one may serve in any of these capacities without first receiving Confined Space Entry training, either as provided or approved by the Office of Environmental Health and Safety (EH&S).

Contractors needing access into a recognized confined space must adhere to the requirements of this program, at the minimum. University contractor liaisons must furnish as available information to the contractor as possible.

### **Responsibilities:**

Various University of Arkansas departments have specific responsibilities under this program.

#### **Office of Environmental Health and Safety (EH&S)**

- Serves as primary resource and contact on confined space issues;
- Maintains, revises, and distributes this program to appropriate campus departments;

- Assists in the evaluation and identification of confined spaces;
- Oversees calibration of atmospheric monitoring equipment used for confined space entry work;
- Performs air monitoring or testing;
- Develops and presents confined space safety training and maintains applicable records.

### **Entry Supervisors**

- Ensure overall employee compliance with this program especially training;
- **In conjunction with EH&S personnel** assist in the development and review of confined space entry permits before signing and authorizing a permit-required confined space entry;
- Communicate with contractors about confined space work and disclose known hazards.
- Ensure a rescue team is available (prearranged outside rescue service **Fayetteville Fire Department**);
- Determine if conditions are acceptable for entry;
- **In conjunction with EH&S personnel** provide air monitoring instruments and all other safety equipment;

### **Attendants**

- Receive confined space training to safely observe and support entrants from outside of confined spaces;
- Prevent entry by unauthorized personnel;
- Understand the hazards or potential hazards of confined spaces;
- Continually observe and communicate with entrants to help ensure the safety of entrants, being on the alert for any signs or symptoms that might indicate hazardous conditions;
- Monitor activities inside and outside the space to ensure that it is safe for entrants to remain in the area;
- Remain at the entry of a confined space until relieved by another attendant;
- Order entrant(s) evacuation if any hazardous condition develop during the entry;
- Perform a non-entry rescue and/or summon rescue in the event of an emergency.

### **Authorized Entrants**

- Make actual entries into confined spaces;
- Understand confined space hazards;
- Read and understand the entry permit requirements;
- Properly use the personal protective equipment that is specified by the permit;
- Immediately exit the confined space when:
  - They are ordered to do so by authorized attendant.
  - They notice or recognize signs or symptoms of exposure.
  - Alert attendants when a prohibited condition exist.
  - An alarm sounds.

## **Identification of Confined Spaces:**

The Office of Environmental Health and Safety shall ensure a survey of the work site is conducted to identify confined spaces. This survey can be partially completed from initial and continuing site characterizations, as well as from other available data (i.e., blueprints and job hazard analysis). The purpose of the survey is to develop an inventory of those locations and/or equipment at U of A that meet the definition of a confined space. Potential entrants are trained to always review the characteristics of a potential confined space against the decision flow chart shown in **Appendix B**. This information shall be communicated to personnel, and appropriate confined space procedures shall be followed prior to entry. The initial surveys shall include air monitoring to determine the air quality in the confined spaces. The potential for the following situations shall be evaluated by EH&S:

- Flammable or explosive potential
- Oxygen deficiency
- Presence of toxic gases or corrosive material

## **Entry Permits:**

Most confined spaces on campus carry very low hazard potential, and generally may be entered safely following the basic procedures outlined in **Appendix B**. However for higher hazard locations, Entry Permits must be completed prior to entry. Entry Permits are standardized written documents that help ensure appropriate precautions are taken prior to entry into higher hazard Permit-Required Confined Spaces. They require supervisor authorization before entry and must be posted continuously at the entry site for the duration of the work.

Three kinds of Entry Permits are available, depending on the kind of space to be entered.

- Permit-Required Confined Space Entry Permit (**Appendix C**);
- Alternate-Entry Permit (**Appendix D**), which is used when the only potential hazard is atmospheric and it can be managed;
- Underground Electrical Installation Entry Permit (**Appendix E**), which is only used for routine work in electrical vaults.

Regardless of type, Entry Permits must remain at the job site until entry work is completed. After use, permits must be returned to the applicable supervisor, and retained in department records for at least 2 years.

## **Entry Procedures:**

The following steps must be taken before entry is made into any known or suspected confined space:

- Use the Confined Space Decision Flow Chart (**Appendix B**) to determine if a space meets the definition of a Confined Space, and if so, what procedures are required for entry.

- Organize and obtain required forms and equipment as follows:
  - Applicable Entry Permit,
    - Permit- Required Confined Space Entry Permit (**Appendix C**),
    - Alternate Entry Permit (**Appendix D**),
    - Underground Electrical Installation Entry Permit (**Appendix E**).
  - Coordinate with Environmental Health & Safety for support with air monitoring (Check battery and calibration),
  - Ventilation equipment and power supply,
  - Qualified attendant and appropriate communication equipment,
  - Tripod, winch, and full body harness (for vertical entry), and
  - Barricades as needed.
- All energy sources that are potentially hazardous to confined space entrants shall be secured, disconnected, and / or restrained before personnel are permitted to enter the confined space. Equipment systems or processes shall be locked out and / or tagged out as required by the U of A Lock-Out/Tag-Out (LOTO) procedures.
- Perform initial air monitoring with a B&W GasAlertMax XT2 4 gas meter or other EH&S approved meter that has been calibrated with all sensors in operation.
  - Turn meter on and check battery charge.
  - Confirm that **oxygen, lower explosive limit, hydrogen sulfide, and carbon monoxide** are operating and reading normal levels. Reset meter in a clean environment before using meter in a confined space. If meter cannot be reset to normal levels, or any sensors are malfunctioning, stop work until another operating meter can be obtained.
- For manhole entries insert probe into opening of the manhole lid or other access point, and sample for at least 30 seconds.
- If readings are within acceptable levels, continue to sample the atmosphere by lowering the probe through the lid opening to several different heights above the floor. Allow adequate time for the instrument to draw the sample up the extended hose and conduct the analysis, typically 30 to 60 seconds. These samples will be analyzed for heavier-than-air gases that could be found near the bottom of the space. Where interconnected spaces are blinded off, each space should be monitored separately. The most hazardous conditions found in any portion of the area dictate the appropriate action to be taken.
- Record all monitoring results on the Entry Permit Form. If unacceptable readings and/or alarms are activated during any monitoring test, the atmosphere is to be considered unsafe for entry. Ventilate for a least 5 minutes and resample. If the atmosphere has not cleared after this initial forced ventilation attempt, **DO NOT ENTER THE SPACE!** Contact your supervisor and EH&S. The source of contamination must be identified and eliminated before any entry can occur.
- If a hazard cannot be eliminated or reduced to a safe level through engineering and / or work practice controls the decision will be made as to using an outside contractor with specialized training in Permit Required Confined Space operations or utilizing confined space trained University of Arkansas employees. The Office of Environmental Health and Safety will assist with this determination.
- Personal Protective Equipment (PPE). If a hazard or unsafe condition exist proper PPE should be used. EH&S shall determine the appropriate PPE needed by all personnel entering the confined space, including rescue teams. Personal Protective Equipment (PPE) that meets the specifications of applicable standards shall be selected in accordance with the requirements of the job to be performed and so stated in the Confined Space Permit.

- Ingress / Egress Safeguards. A means for safe entry and exit shall be provided for confined spaces. Each entry and exit point shall be evaluated by EH&S to determine the most effective methods and equipment that will enable employees to safely enter and exit the confined space.

Appropriate retrieval equipment or methods shall be used whenever a person enters a confined space. Use of retrieval equipment may be waived by EH&S if use of the equipment increases the overall risk of entry or does not contribute to the rescue. **A mechanical device shall be available to retrieve personnel from vertical confined spaces greater than five (5) feet in depth.**

### **Hazards and Safe Work Practices:**

The following kinds of hazards may potentially exist in confined spaces. Each hazard is followed by a description of recommended safe work practice(s) for eliminating or controlling the hazard.

- **Excess Pressure Hazards**

The buildup of pressure inside a space can create a serious physical hazard during cover/hatch opening. Pressure build-up could occur as a result of internal reactions inside the space, or from a very tightly sealed space has not off-gassed.

Safe Work Practice: Pryor to removing any entry manhole cover or hatch, visually inspect the area for any obvious discoloration, deterioration, or deformation. Pryor to physically touching the cover, hold your hand above the cover to determine if it is excessively warm. The presence of vent or hook holes may prevent pressurization of the space. If no vent or hook holes are present, open the cover gradually to release residual pressure that may be present. After removing cover/hatch, install a safety barrier to prevent an accidental fall into the space.

- **Atmospheric Hazards**

Atmospheric hazards are among the most common hazards posed by confined spaces. The atmosphere inside a confined space is considered hazardous if it contains dangerous concentrations of certain contaminants, is deficient in or overly enriched with oxygen, or if it contains sufficient flammable vapors or gas to be potentially explosive.

Safe Work Practice: Confined spaces must always be tested prior to entry to determine whether an oxygen deficient, flammable, or toxic atmosphere exist. Acceptable atmospheric levels are:

Oxygen	19.5 to 23.5 %
Flammable (% of Lower Explosive Limit)	< 10 %
Carbon Monoxide	< 35 ppm
Hydrogen Sulfide	< 10 ppm



Atmospheric monitoring must be made with a calibrated, EH&S- approved alarming multiple gas monitor. Employees may only enter a confined space after initial testing indicates that no atmospheric hazards exist; continuous monitoring is required while a confined space is occupied. Workers must immediately leave the space if any of the gas monitor alarm set points are reached. Workers may not return into the space until forced ventilation has been completed and the gas detector indicates that it is safe to re-enter. In addition to the multi-gas, individuals entering into atmospheric hazard confined spaces must also wear a personal, direct reading, alarming oxygen meter calibrated to the same set points as above.

Note: For routine work inside Underground Electrical Vaults, forced ventilation must be applied at all times even if initial monitoring indicates safe atmospheric conditions. Entrants must immediately exit the confined space if any gas monitor alarm set points are reached, and also if the forced ventilation system shuts down or fails.

- **Electrical hazards**

Confined spaces may also present serious electrical shock or electrocution hazards from potentially defective cables, the presence of water (flooded Vault) in contact with electrical wiring, or by accidental physical contact with charged cables or wire leads.

Safe Work Practice: The risks from electrical hazards depend upon the presence and conditions of electrical sources and conduits inside the space, the physical configuration of access, and the activity or work to be conducted inside the confined space. Employees are cautioned to NOT ENTER THE SPACE if an electrical shock potential is identified.

Note: Underground Electrical Vaults may be entered without additional electrical hazard protections for “routine work” only. “Routine work” here refers to non-evasive, low hazard activities such as inspection, meter or dial reading, housekeeping, and other similar work. Entries into these kinds of locations for any other purpose other than routine work may only occur under either a Permit- Required or Alternate Entry Procedure, using the appropriate entry permit, attendant, and rescue equipment. Entry into Restricted Access High Voltage Areas, which contain Exclusions Zones for arc flash protection require escort from Power Distribution personnel.

- **Engulfment Hazards**

Engulfment hazards are either active or potential conditions that could crush, suffocate, drown, or otherwise engulf or incapacitate an entrant. The most common examples of confined space engulfment hazards on campus are the presence of high water levels or the potential for flooding while working inside a confined space. Other less common engulfment hazards are possible from the shifting or collapse of surrounding soil or sand, and the release or falling of supplies or other materials stored inside a confined space.

Safe Work Practice: Before an entry is performed, confined spaces must be thoroughly visually inspected for potential engulfment hazards. Accumulated water must be pumped out of the space before entry is made. If there is potential for flooding from an incoming feed pipe or valve, an appropriate lock-out/tag-out must be applied to prevent inadvertent flooding.

- **Accumulated Water Hazards**

Small amounts of water often accumulate in the base of many confined spaces, especially those located outdoors. When water accumulates in excess of dampness or minor wetting, it can create or mask other hazards. These include slippery walking surfaces, the obscuring of trip or fall hazards, and increasing the potential for electrical hazards.

Safe Work Practice: Prior to entry, accumulated water must be pumped down to ensure a clear and unobstructed view into the space, and visually confirmed as free from other recognizable hazards. Portable electrical lighting and other equipment for use inside a wet or damp confined space must be limited under most circumstances to self-contained battery operated devices, or protected by a functioning Ground Fault Circuit Interrupter (GFCI).

- **Entrant-Generated Hazards**

Certain maintenance and repair operations performed in confined spaces have the potential to generate their own hazards. Some examples include: 1) the use of volatile cleaning, stripping, or coating chemicals that can pose toxicity, flammability, or oxygen displacement hazards; 2) introduction of flames and other ignition sources through welding or cutting work; and 3) high exposures to silica and metal during sandblasting operations.

Safe Work Practice: Prior to making any confined space entry, the authorized entrant(s) and their supervisors must review the anticipated purpose of the entry and any planned work activities. Special attention must be given to evaluating and controlling hazards from in-space work activities, e.g., additional local exhaust or supply ventilation, changing chemical products to lower hazard materials, working remote, etc. Contact EH&S for additional information on controlling hazardous operations; hot work also requires review by the University of Arkansas Fire Marshal in advance.

### **Employee Qualifications and Training:**

Individuals involved in any aspect of work with confined spaces work must receive confined space safety training. This training must cover: (1) classification and evaluation of confined spaces, (2) confined space hazards, (3) the University's Confined Space Entry Program, (4) appropriate use and care of atmospheric monitoring equipment, (5) forced ventilation, and emergency procedures, including the use of rescue equipment. Employees must successfully complete this training before any confined space entry, attendant, or supervision work is performed. Refresher training will be conducted on a yearly basis or as needed to maintain employee competence in entry procedures and precautions. This training will be conducted by EH&S.

## **Emergency Rescue Procedures:**

Emergencies during a confined space entry can have catastrophic results if entrants, attendants, and potential rescuers have not developed a plan of action in advance. Appropriate means for rescue must be established prior to entry, selected from the following gradations of rescue procedures:

- **Self- Rescue**

Entrant self-rescue generally provides the most effective means of escaping a recognized confined space hazard. Self-rescue must immediately be effected whenever an entrant, fellow entrant, or attendant recognizes the presence of a hazardous atmosphere, any signs or symptoms of over-exposure, or any other serious space hazards. Self-rescue must be implemented in the event of forced ventilation system failure during entry inside an Underground Electrical Vault.

Self-rescue requires entrants to safely stop whatever they are doing and exit the space in the most expedient and safe manner possible. Self-rescue is simple, fast, provides individuals with the ability to alert fellow workers, and does not require anyone else to enter the space, thereby avoiding the endangerment of more workers. The obvious drawback is that it requires the entrant to be conscious and physically mobile, and therefore unsuited for entrants who have suffered serious exposure or injury.

- **Non-Entry Rescue**

When self-rescue is not possible due to unconsciousness or incapacitation of an entrant, non-entry rescue should be initiated. Under this method, a mechanical retrieval system shall be available to physically extract, lift, or pull entrants from the confined space without requiring any additional persons to enter the space. Retrieval systems shall consist of a full body harness with a retrieval line attached to a “D” ring at the center of the back, a winch and tripod that can be operated from the outside of the confined space by the attendant. A retrieval system shall be available to retrieve personnel from vertical confined spaces more than (5) feet deep. Non-entry rescue reduces the risk of collateral injury to rescuers, but it is only effective on simple vertical or clear horizontal spaces. Since mechanical retrieval of unconscious or incapacitated entrants from complex, convoluted spaces can cause serious injuries from entanglement, strangulation, and blunt force impacts, this method of retrieval must be carefully evaluated before implementation.

- **Entry Rescue**

Entry rescue is the most dangerous form of confined space rescue since it requires additional persons to enter into the very space that caused the injury or over-exposure to the entrant(s). Entry rescue may only be attempted by appropriately trained individuals possessing active certifications in and knowledge of first aid/CPR, self-contained breathing apparatus, rescue/retrieval equipment and technical rescue training.

An entry rescue plan must be developed prior to implementing this level of rescue responsibility, and include the following elements:

- Barricades for traffic/crowd control,
- Additional ventilation options,
- Controls for other potential hazards (e.g., cave-ins, fire),
- Protective clothing and equipment,
- Explosion-proof lighting equipment,
- Redundant methods of communication,
- Standby rescue team,
- Victim removal procedures and devices,
- Available emergency vehicles
- Medically trained personnel

### **Recordkeeping:**

The Office of Environmental Health and Safety shall maintain an inventory of recognized confined spaces, training records, safety audits, and incident/accident investigations. Owner departments maintain copies of completed entry forms, and service and maintenance records for work in all locations, including confined spaces.

### **Contractors and Visitors:**

Contractors, vendors, and other visitors are responsible for their own health and safety programs, including programs for any confined space entry work. The programs must meet the requirements of this program at a minimum. University contacts and liaisons with these individuals are responsible for sharing information about known or suspected confined spaces in advance.

Source: Environmental Health and Safety

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