



UNIVERSITY OF
NORTHERN COLORADO

Environmental Health and Safety

**CONFINED SPACE ENTRY
PROCEDURE**

September 2023



UNIVERSITY OF
NORTHERN COLORADO

Environmental Health and Safety

CONFINED SPACE ENTRY PROCEDURE

Table of Contents

- I. Purpose
- II. Definitions
- III. Categories of Confined Spaces
- IV. Potential Hazards
- V. Confined Space Entry Work Procedures
 - A. Identification and Labeling of Confined Spaces
 - B. Planning Confined Space Entry Work
 - C. Confined Space Entry Permit
 - D. Responsibilities
- VI. Safety Equipment and Personal Protective Equipment
- VII. Training and Recordkeeping

Appendices

- Appendix A: Permit Required Confined Space Entry Procedure Form
- Appendix B: UNC Confined Space Entry Permit
- Appendix C: Confined Space Entry Permit Inventory Locations



UNIVERSITY OF
NORTHERN COLORADO

Environmental Health and Safety

CONFINED SPACE ENTRY PROCEDURE

I. Purpose

One of the most common causes of fatal industrial accidents involves confined spaces, which may include boilers, furnaces, manholes, pipelines, utility vaults, sewers, storage tanks and below ground rooms. Confined space work is particularly hazardous due to the difficulty in detecting and quick onset of the possible dangers involved. A good rule of thumb is to consider any hazard in a confined space as having a much greater potential for risk than similar work done under normal conditions. This document is intended to establish safety policies and procedures for confined space entry in accordance with guidelines provided by OSHA in 29 CFR 1910.146.

Effective control of confined space entry is a complex task on the University of Northern Colorado (UNC) campus as the regulatory definition of confined space is broad and will apply to a number of various locations. Department tasks are highly varied and in some cases, the need for confined space entry cannot be predicted beforehand. In addition, a large number of people may be involved including representatives from several departments and outside contractors. In order to make this procedure effective and practical, the intent is to limit the number of individuals with the authority to issue permits (confined space entry supervisors), and prescribe the use of personal protective equipment and special procedures for confined space entry. Each confined space entry supervisor is responsible for specific areas on campus and for specific tasks associated with the trades and department they supervise. These assignments will be delegated according to the individual's assigned duties for UNC.

The key factors in making this system work are knowledge, participation, attentiveness, training, and prior planning on the part of the confined space entry supervisors, attendants, and workers.

II. Definitions

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

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

Confined Space – a space that:

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

Engulfment: the flow of liquid or loose particles into the space trapping, crushing, and smothering/drowning the entrant.

Entrapment: where the configuration of the inside of the space traps or smothers an entrant because of inwardly converging walls, or a floor which slopes down and tapers to a smaller cross section.

Entrant: any person(s) who is required to perform work inside a confined space.

Entry permit: the document that is provided by the employer to allow and control entry into a permit space containing the information specified in Appendix B.

III. Categories of Confined Spaces

For the purpose of this document, confined spaces are divided into two categories: **low risk (non-permit)** spaces and **high risk (permit required)** spaces.

- **Low-Risk Spaces (Non-Permit)** – Primary hazards are remoteness, confinement, communication difficulty, and consequences of physical hazards such as slips and falls, and falling objects. These spaces do not have the potential to cause death or serious physical harm.
- **High-Risk Spaces (Permit Required)** – Primary hazards are engulfment, entrapment and/or hazardous atmospheres. Quick rescue could be impeded by a hazardous atmosphere or by the physical configuration of the space. High risk spaces also have the potential to contain any hazards of a low-risk space.

IV. Potential Hazards

Hazardous Atmospheres

- Oxygen deficient – deficient atmospheres (19.5% or less) are a result a decrease in oxygen due to consumption or displacement
- Oxygen enriched – enriched atmospheres (22% or above) provide the potential for flammable materials to burn.
- Flammable atmospheres – any atmosphere containing gas, vapor, or flammable dust in excess of 10% of its Lower Explosive Limit (LEL). Hot work (permit required work involving torch cutting or welding) and other work generating extreme heat or flame must be monitored continuously. (See UNC Hot Work Program)
- Toxic atmospheres – any atmospheric concentration of a gas or vapor exceeding its Permissible Exposure Limit (PEL). Hazard has a direct effect on human health and may require the use of respirators and other personal protective equipment (PPE).

Mechanical Hazards – moving or rotating parts and other energy sources including pumps, process lines, electrical sources, etc., must be identified. Proper Lockout/Tagout procedures must be followed when necessary.

Physical Hazards – extreme heat/cold, falling objects, slippery surfaces, noise, vibrations, engulfment, or entrapment are all potential hazards of high risk confined spaces.

V. Confined Space Entry Work Procedures

The following sections describe procedures for working in confined spaces and must be done when confined space is performed. If needed, a “Permit Required Confined Space Entry Procedure” form is attached. (Appendix A)

A. Identification and labeling of confined spaces

Confined space entry supervisors must identify spaces within their area of jurisdiction which fall under the definition of a “confined space.” A list of these spaces shall be submitted to the Environmental Health & Safety Director. These areas will be compiled for the entire campus and categorized as a high risk (permit required) or low risk (non-permit) area. The confined space inventory list will be available through the Environmental Health and Safety Department. The inventory list will be reviewed and updated every two years.

Each high risk (permit required) area will be labeled with a hazard warning at the entrance to the confined space reading: **“WARNING - CONFINED SPACE HAZARD – ENTRY PERMIT REQUIRED”**. Barriers shall be constructed to avoid entry by non-authorized personnel. If new areas are identified, they will also be labeled and added to the list, and the list will be re-distributed as specified above.

B. Planning for confined space entry work

Entry into a confined space for maintenance or other work may require extensive pre-planning and monitoring for hazardous conditions. This is especially true for entry into high risk, permit required areas.

The following activities must be *planned* before entry into any confined spaces:

- Determine the type of work and space to be entered
- Assess potential risks and hazards using:
 - Current atmospheric readings
 - Previous Permits to identify hazards and unanticipated risks or situations
 - Personal and collective knowledge about the space: location, substances, equipment, and processes within it

Atmospheric monitoring

To ensure that employees will not be placed at risk due to a hazardous atmosphere, monitoring before and during a confined space is mandatory.

- Analysis of the air inside a confined space must be accomplished *before* workers enter the space to determine whether a Permit is required for this entry, including the types of respiratory protection that may be needed.
- The trained attendant must perform testing with at least a 4 gas monitor (O₂, H₂S, LEL, CO) *before an employee enters* a confined space.
- Entrant must also take a monitor into the confined space.
- Testing for other specific gases must be performed *if there is a potential* for their presence. Arrangements for additional special testing can be made with Environmental Health and Safety in advance.
- Once workers enter the confined space, monitoring of the atmosphere should be continued regularly through the use of portable monitors designed to sound an alarm in the presence of a hazardous atmosphere

Ventilation

Forced-air ventilation (purging) can help disperse hazardous gases, as well as correct oxygen deficient atmospheres. Generally, a large fan is used to force air through a large diameter hose that is placed and fastened within the confined space. Constant ventilation must be provided to avoid harmful gases from re-accumulating in the space. Ventilation is more effective when there is an exhaust as well as an entry vent. Constant air monitoring is required under these conditions.

Lockout/Tagout

Lockout/Tagout procedures must be performed, if necessary, for specific tasks presenting mechanical hazards. Further details can be found in the UNC Electrical Safety Guidelines.

Isolation

In order to protect/prevent public bystanders from hazards posed by confined spaces, proper isolation procedures may need to be in place before proceeding with work. Warning signs and physical barriers help prevent unauthorized entry and may also protect workers from external hazards.

C. Confined Space Entry Permit

The Confined Space Entry permit is the written procedures for preparing and entering a Permit Required Confined Space. This includes a checklist for safety precautions to be taken before entry is authorized and are to be completed **EVERY TIME** an entry is made.

An example of the UNC confined space entry permit is included (Appendix B). Copies of the permit should be routed through the standard organizational chains of authority within the department sponsoring the entry activity.

Preplanning for unanticipated emergency entries is essential. The Permit for any reasonably probable emergency entry should be *prepared in advance* and quickly reassessed just prior to the actual entry so that employees are afforded the necessary safety whenever they must enter a permit required confined space.

D. Responsibilities

Supervisor

Every supervisor whose employees are required to enter a confined space is a Confined Space Entry Supervisor and is responsible for the following:

- Identification and labeling of confined spaces in their jurisdiction
- Planning, scheduling of confined space entry work (when required), and issuing permit(s)
- Designate workers and assign specific tasks and roles. One or more persons may enter a confined space to do the necessary work.
- Ensure that all equipment is available and working properly
- Ensure that all employees receive proper training on procedures and equipment
- Ensure proper entry procedures are followed
- Remain in contact with the attendant and give required direction throughout the entry, and terminate the entry and permit in case of emergency or when complete
- Provide decision making should unanticipated circumstances arise during the entry
- Schedule a specific time and date for the entry operations and ensure beforehand that all participants are notified, and all equipment is available and prepared
- Prepare an escape plan and decide on standby rescue procedures. Greeley Fire Department (GFD) is UNC's rescue resource on campus. UNC personnel **DO NOT** attempt rescue functions
- Analyze and distribute the completed Permit to EHS

Attendant

At least one person, the Attendant, must stay immediately outside the space throughout the entire entry.

The role of the Attendant is to:

- Notify UNCPD Dispatch that the Permit Required Confined Space Entry is commencing, the nature of work, number of entrants, location, and expected duration of the entry
- Maintain and record the visual, oral, and/or radio contact with the space entrant(s) and atmospheric or related tests.
- Remain in contact with the supervisor and convey any unanticipated circumstances so a decision can be made to continue or terminate the entry.
- Evacuate the entrants should any circumstance warrant terminating the entry or until further direction can be obtained from the supervisor.
- Contact UNC Dispatch via radio or by dialing 351-2245 or 911 in an emergency to summon rescue if the space entrant(s) encounter difficulty or when entry is terminated
- Relay information to rescue authorities (GFD)

Entrant

Entrants are responsible for and shall receive training in the following:

- Knowledge of hazards that may exist during entry, including signs, symptoms, and consequences of exposure
- Proper use of equipment including atmospheric monitoring equipment, ventilation equipment, communication equipment, Personal Protective Equipment, barriers, and rescue equipment
- Maintain communication with the attendant in order to enable the attendant to monitor entrant status and to alert entrants when evacuation is necessary
- Alert the attendant when a hazardous condition is detected
- Exit the confined space as quickly as possible when an evacuation is necessary or a dangerous condition is detected

No UNC employee or contractor shall enter a Permit Required Confined Space unless the activity has been discussed, planned beforehand and a permit is signed and activated.

VI. Safety Equipment and Personal Protective Equipment

In order to properly and safely perform work in confined spaces, specific safety and personal protective equipment may be required. The department which needs to enter the confined space is responsible for procuring and maintaining safety equipment. Equipment which **may** be required includes but is not limited to:

- Personal protective equipment including safety boots, gloves, hard hats, safety glasses and hearing protection
- Radios, cell phones, or an electronic signaling system for communication (Not to be used in explosive atmospheres as indicated by LEL 10% or greater). A radio is to be used at the site by the attendant to access UNCPD for immediate emergency communication
- Atmosphere testing and monitoring equipment for toxic gas, flammable gas detection and oxygen levels. This Equipment may not be used when multiple entrants enter unless an area has been pre-approved by the Confined Space Entry Supervisor
- Harnesses, winches, tripods, safety lines, scaffolds or other fall protection. This equipment may not be used when multiple entrants enter a confined space unless an area has been pre-approved by the Confined Space Entry Supervisor
- Portable ventilators / blowers for ventilating the space
- Respiratory protective equipment including dust masks, air purifying respirators, supplied air respirators, self-contained breathing apparatus or escape air units
- Lockout/Tag out equipment and supplies

VII. Training and Recordkeeping

All employees required to perform confined space entry work, including entry supervisors, shall receive confined space entry training at least every 2 years to be considered current. The Environmental Health and Safety Department and the confined space entry supervisors will coordinate and plan the training.

All forms and other documentation concerning Confined Space Entry will be kept on file with the Department of Environmental Health and Safety. This includes training records, preplanning forms, completed entry permits, and lists of known confined spaces on campus. All documentation will be kept on file for at least 3 years.

Appendix A.

Permit Required Confined Space Entry Preplanning

| Action | Responsible Person | Complete? |
|---|------------------------|-----------|
| Assess confined space for risks and hazards | Supervisor | |
| Preplan entry | Supervisor | |
| Prepare permit | Supervisor | |
| Notify entrants and attendants | Supervisor | |
| Ensure availability of equipment | Supervisor | |
| Meet with entrants and attendant just prior to entry | Supervisor | |
| Remain in contact with attendant throughout entry | Supervisor | |
| Set up equipment at entry site | Entrants and attendant | |
| Obtain atmosphere monitor and police radio from Dispatch | Attendant | |
| Review permit with all entrants | Attendant /entrants | |
| Take pre-entry atmosphere reading | Attendant | |
| Notify Dispatch before CSEntry is about to start. Advise location, number of entrants, nature of work and approx. duration | Attendant | |
| Maintain contact with entrant(s) at specified intervals. Log. | Attendant | |
| Conduct space monitoring at specified intervals. Log. | Attendant | |
| Emergency If <input type="checkbox"/> No communication from entrant(s), <input type="checkbox"/> Monitoring indicates abnormality, <input type="checkbox"/> Attendant must leave, <input type="checkbox"/> Supervisor advises, Call out entrants immediately, and get direction from supervisor to continue or terminate entry | Attendant | |
| Emergency Contact UNCPD Dispatch in emergency to summon rescue | Attendant | |
| Emergency UNCPD Dispatch calls Fire Dept and sends UNC Police Officer to site | UNC PD Dispatch | |
| Emergency Convey necessary info to Fire Dept rescue | Attendant | |
| Advise Dispatch when Entry Terminated | Attendant | |
| Return police radio and atmosphere monitors to Dispatch and sign in | Attendant | |
| Recharge and calibrate monitors | EHS Specialist | |
| Sign off Permit and return to Supervisor | Attendant | |
| Analyze entry, close permit and file | Supervisor | |

Appendix B.

| | | | |
|--|----------|---|------------------------|
| University of Northern Colorado Facilities Management | | Confined Space Entry Permit | |
| | | THIS PERMIT VALID FOR 8 HOURS ONLY COPY MUST BE AT JOB SITE UNTIL COMPLETED | |
| Location or I.D. #: | | Type space: <input type="checkbox"/> Storm Drain <input type="checkbox"/> Sanitary Sewer <input type="checkbox"/> Utility vault | |
| | | Other: _____ | |
| Air Monitor Brand Name: | Model #: | Serial #: | Last Calibration Date: |

Record Levels and Time of Test

| Test to be Taken | Yes | No | TLV* | Time | Time | Time | Time | Time | Time |
|--------------------------|-----|----|------------------|------|------|------|------|------|------|
| % Oxygen | | | <19.5% or >23.5% | | | | | | |
| % LEL** Comb. | | | 10% | | | | | | |
| Carbon Monoxide (Tox 1) | | | 35 PPM | | | | | | |
| Hydrogen Sulfide (Tox 2) | | | 10 PPM | | | | | | |
| VOC | | | | | | | | | |

Name of Person(s) Testing Atmosphere: _____

* TLV – Threshold Limit Value – (8 hour time-weighted average concentration t which all workers may be continuously exposed without adverse health effects)

** LEL – Lower Explosive Limit

| Special Requirements | Yes | No | Personal Protective Equipment | Yes | No |
|------------------------------------|-----|----|-------------------------------|-----|----|
| Work Site Protection | | | Protective Clothing | | |
| Ventilation | | | Body Harness | | |
| Lock Out/Tag Out | | | Filter Respirator | | |
| Lines Broken, capped or blanked | | | SCBA/Supplied Air Respirator | | |
| Lighting | | | Emergency Escape Respirator | | |
| Fire Extinguishers | | | Means of Entry/Exit | | |
| Tripod/ Retrieval Equip./Lifelines | | | Physical Hazards Precaution | | |

Communication Type: Voice Radio Intercom Rope signals Other: _____

Communication System Functional: Yes No Rescue Plan Defined: Yes No

Emergency Services Standby: Yes No Phone # 911 or 351-2245 Radio Contact – UNCPD

Hot work to be performed: Yes No If Yes, Hot work Reviewed: Yes No

Actual Entry Time (First Person In): _____ Actual Exit Time (Last Person Out): _____

Authorized Entrants:

1.) _____

2.) _____

3.) _____

Attendants:

1.) _____

2.) _____

3.) _____

I certify that I have inspected the work area for safety and reviewed all necessary precautions recorded on this permit.

Entry Supervisor: _____
Print name Signature Date Time

This permit has been terminated:

Print Name Signature Date Time

Reason for Termination: Work was completed
 Unforeseen Hazards – List Hazards _____
 Other _____

In case of an emergency or rescue call UNCPD immediately.

Contact by Radio, 911 or (970) 351-2245

Appendix C.

University of Northern Colorado

Confined Space Inventory

All sewers, manholes are Permit Required. All Permit required spaces MUST be tested for oxygen, LEL, CO and H2S before planning entry AND before and during actual entry. Call EHS if you know of a confined space not on this list.

Confined Spaces

Central Campus

| Space ID # | Building | Room | Type of space | Comments | PERMIT? |
|------------|-------------------|----------------------------|--------------------------------|--|---------|
| | Frasier | Basement Mechroom | Steam Production | | ✓ |
| | Frasier | tunnels | Under building | For steam line- | X |
| | Music library | none | none | | |
| | Carter | Basement | Utility tunnels under building | | X |
| | Kepner | none | none | | |
| | Crabbe | Tunnel Mechroom | Steam prod. | | X |
| | Gray | Basement | Tunnels | | X |
| | Gunter | Tunnel Mechroom | Steam prod. | | ✓ |
| | Gunter | Utility Tunnel South side. | Tunnel to Belford | Crawl Tunnel very limited access and not lit. Connects at South side utility tunnel. | ✓ |
| | Gunter | NW of Building | Meter Pit | Domestic water meter for Central Campus | ✓ |
| | Bond to Dickerson | Mechrooms both buildings | Utility Tunnel | Access from Manhole | ✓ |
| | Tobey-Kendal | Tunnel Mechroom | Steam prod. | | X |
| | Bond Hall | Main Mechroom | Valve vault | | X |
| | Weibking | Main Mechroom | Domestic tank | | ✓ |
| | Wilson | Main Mechroom | DomesticTank | | ✓ |

| Space ID # | Building | Room | Type of space | Comments | PERMIT? |
|------------|---------------|--------------------------|----------------------|----------------|---------|
| | Belford | AHU Mechroom | DomesticTank | | ✓ |
| | Gordon | AHU Mechroom | DomesticTank | | ✓ |
| | Snyder | AHU Mechroom | DomesticTank | | ✓ |
| | Decker | AHU Mechroom | DomesticTank | | ✓ |
| | Hansen-Willis | Main Mechroom | DomesticTank | | ✓ |
| | Faculty Apt 1 | Main Mechroom | DomesticTank | | ✓ |
| | Tobey-Kendal | Main Mechroom | DomesticTank | | ✓ |
| | Tobey-Kendal | Outside east of building | Domestic Water Meter | Manhole access | ✓ |
| | Sabin | AHU Mechroom | Domestic Tank | | ✓ |
| | Jackson Field | North parking lot | Mechanical vaults | 3 vaults total | ✓ |

Confined Spaces

West Campus

| Space ID # | Building | Room | Type of space | Comments | PERMIT? |
|------------|-------------------------------|------------------------|-------------------------|---|---------|
| | Bishop Lehr | Equipment rm | tank | DHW tank confined | ✓ |
| | Bishop Lehr | tunnels | | | X |
| | University Center | Entrance to North lot. | Meter Pit | UC domestic meter to West Campus loop | ✓ |
| | 14 th Ave Entrance | East side of street | Meter Pit | Second domestic meter to West Campus loop | ✓ |
| | Ross Hall | New Wing Penthouse | Exhaust plenum | | ✓ |
| | Ross Hall | 89 Wing Penthouse | Exhaust plenum "89 wing | hazardous atmosphere | ✓ |
| | Ross hall | | Volatile Storage room | Hazardous atmosphere | ✓ |
| | Lawrenson | Main Mechroom | Tank | DHW | ✓ |

| Space ID # | Building | Room | Type of space | Comments | PERMIT? |
|------------|------------|------------------------------|---------------------|------------------------|---------|
| | Lawrenson | Main Mechroom | Tank | DHW | ✓ |
| | Lawrenson | Main Mechroom | Tank | Condenser tank chiller | ✓ |
| | Lawrenson | | manholes | Domestic water meter | ✓ |
| | CBII | Main Mechroom | Tank | DHW | ✓ |
| | CBII | Main Mechroom | Tank | Condenser tank | ✓ |
| | CBII | J0284 | Elevator Pit Access | Trap Door in Floor | X |
| | McKee Hall | Main Mechroom | Tank | DHW | ✓ |
| | McKee Hall | Main Mechroom | Tank | Condenser Water | ✓ |
| | Michener | Main Mechroom | Tank | Condenser Water | ✓ |
| | Michener | Main Mechroom | Tank | Condenser Water | ✓ |
| | Michener | North And South walk tunnels | Pipe chase access | | ✓ |
| | Turner | Main Mechroom | Tank | DHW | ✓ |
| | Turner | Main Mechroom | Tank | DHW | ✓ |
| | Turner | Main Mechroom | Tank | Condenser | ✓ |
| | Turner | | Manhole | Domestic water meter | ✓ |
| | Harrison | Main Mechroom | Domestic Tank | DHW | ✓ |
| | Harrison | Main Mechroom | Domestic Tank | DHW | ✓ |
| | Harrison | | Manhole | Domestic water meter | ✓ |

Confined Spaces***East Campus***

| Space ID # | Building | Room | Type of space | Comments | PERMIT? |
|------------|------------|----------|----------------------|------------------------------------|---------|
| | Heat plant | basement | Flash tank | Confined, blanked off lines | ✓ |
| | Heat Plant | basement | Make up tank | Confined, blanked off lines | ✓ |
| | Heat Plant | ground | Boilers | Low risk due to current procedures | X |
| | Heat Plant | no | North expansion tank | | ✓ |
| | Heat Plant | 50 | South expansion tank | | ✓ |
| | Heat Plant | 1 | Fuel Tank | Aboveground Tank | ✓ |

Key: X Depending upon conditions, may be a non-permitted confined space entry

✓ Permit required confined space entry