



UNIVERSITY OF
NORTHERN COLORADO

Environmental Health and Safety

**CONFINED SPACE ENTRY
PROCEDURE**

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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