

CONFINED SPACE ENTRY PROGRAM

University of Dayton

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Approved by:
Robin Oldfield,
Environmental Safety Administrator
University of Dayton
300 College Park Dayton, Ohio 45469-2905
(937) 229-4503 Fax (937) 229-4395
Oldfield@notes.udayton.edu
www.udayton.edu/~env-safe

1.0 POLICY

1.1 It is the policy of the University of Dayton that any individual entering into a confined space on UD property will do so in accordance with the procedures outlined in this document. This document complies with all applicable regulatory standards and includes specific non-regulatory requirements set forth by the Environmental Safety Administrator.

1.2 All persons planning on entering a confined space on campus must obtain a Confined Space Entry Permit from the Environmental Safety Office (ESO) and have it signed by their supervisor. ESO staff or individuals designated by ESO are responsible for air testing confined spaces and completing Confined Space Entry Permits.

1.3 Each department will provide personal protective equipment, operating equipment, and supervision necessary for protection of individual health and safety. All current practices in confined space entry will meet or exceed applicable federal, state and local safety regulations.

2.0 PURPOSE

2.1 To ensure that all individuals entering a confined space adhere to established safety practices and utilize required confined space entry equipment.

3.0 DEFINITIONS

Acceptable entry conditions: the conditions that must exist in a permit 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 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.

Blanking or blinding: the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) 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: a space defined by the concurrent existence of all of the following conditions:

(1) Large enough and so configured that an employee can bodily enter and perform assigned work.

(2) Has limited or restricted means for entry or exit.

(3) Is not designed for continuous employee occupancy.

Examples of Confined Spaces at UD:

Manholes, boilers, tanks, vats, sewer pipelines, vaults without existing general ventilation. Note: Trenches typically are not confined spaces, contact ESO for trench operations requirements prior to work.

Double block and bleed: the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency: any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Enclosed Space: Spaces that do not meet the definition of a confined space, but may require precautionary measures upon entering. Examples of enclosed spaces at UD are crawl spaces and service tunnels with existing general ventilation.

Engulfment: the surrounding and effective capture of a person by a liquid or finely divided (flammable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry: the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrants body breaks the plane of an opening into the space.

Entry Permit: A permit (Appendix A) that must be completely filled out by ESO personnel prior to entering the space. Employees entering confined spaces must have signature approval from their supervisor on the confined space entry permit prior to entry. No permit shall be valid for more than 24 hours after the time of issue by the supervisor.

Hazardous atmosphere: an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit (LFL), or lower explosive limit (LEL).
2. Airborne combustible dust at a concentration that meets or exceeds LFL.
Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.
3. Atmospheric oxygen concentration below 19.5% or above 23.5%.

4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit which could result in employee exposure in excess of its dose or PEL.
5. Any other atmospheric condition that is immediately dangerous to life or health.

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.

Note: Some material-hydrogen fluoride gas and cadmium vapor, for example, may produce immediate transient effects that may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

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.

Note: This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation: the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

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 a substance in air that will produce a flash of fire when an ignition source (heat, arc, or flame) is present. At concentrations lower than the LEL, the mixture is too "lean" to burn.

Non-permit required space: that which 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% oxygen by volume.

Oxygen enriched atmosphere: an atmosphere containing more than 23.5% oxygen by volume.

Permit-required confined space: a confined space that has one or more of the following characteristics:

(1) Contains or has the potential to contain a hazardous atmosphere. Note: Permit procedures are not required where existing ventilation is sufficient to remove potential dangerous air contamination.

(2) Contains a material that has the potential for engulfing an entrant.

(3) 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.

(4) Contains any other recognized serious safety or health hazard.

Note: A full permit is issued for all confined space entries at UD, whether the confined space is designated as permit-required or not.

Upper Explosive Limit (UEL): The highest concentration of a substance in air that will produce a flash of fire when an ignition source (heat, arc, or flame) is present. At concentrations higher than the UEL, the mixture is too "rich" to burn.

4.0 RESPONSIBILITIES

4.1 ENVIRONMENTAL SAFETY OFFICE

- a. Develop, implement and maintain the Confined Space Program and Permit System.
- b. Issue Confined Space Entry Permits to UD personnel or designate campus employees qualified to issue Confined Space Entry Permits.
- c. Provide centralized monitoring and certification of Confined Spaces as requested.
- d. Maintain monitoring records as needed.
- e. Maintain all confined space entry monitoring equipment and calibrate gas detectors as necessary.
- f. Maintain copies of all confined space entry permits, including all air testing results.

4.2 DIRECTORS & DEPARTMENT HEADS

- a. Ensure that each supervisor adheres to these procedures.
- b. Contact ESO prior to initiating contracts with off campus contractors that will involve confined space entry. Specific contract language is required to ensure that contractors provide an adequate level of protection to their employees while working at UD.

4.3 DEPARTMENT SUPERVISORS

- a. Ensure that UD employees under their direct supervision understand and adhere to adopted procedures during confined space entry operations.
- b. Assure that necessary education and training will take place prior to the employee being assigned to work in a confined space (see Section 6.0).
- c. Contact ESO with as much advance notice as possible prior to performing confined space work. Notification should be made 24 hours in advance although immediate entry supervision is available during regular work hours.
- d. Provide necessary operations equipment and resources including confined space attendants.
- e. Identify locations and potential hazards of each confined space that may require entry by employees.

4.4 ENTRY SUPERVISORS

- a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences.
- b. Determine if acceptable entry conditions are present at a permit space where entry is planned.
- c. Oversee entry operations for the duration of assigned work and terminate entry when conditions are determined to be unsafe.
- d. Perform air monitoring as required.
- e. Complete Confined Space Entry Permits (if needed).
- f. Remove unauthorized individuals who enter or who attempt to enter the permit space during entry operations.

4.5 ENTRANTS

- a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences.
- b. Confined space entrants are responsible for reading and complying with procedures and guidelines provided by their supervisors and ESO.
- c. Properly use all equipment as required.
- d. Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space.

- e. Alert the attendant whenever:
 - i. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
 - ii. The entrant detects a prohibited condition.
- f. Exit from the permit space as quickly as possible whenever:
 - i. An order to evacuate is given by the attendant or the entry supervisor.
 - ii. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
 - iii. The entrant detects a prohibited condition.
 - iv. An evacuation alarm is activated.
- g. Ensure that his/her confined space entry training is up to date.

4.6 ATTENDANTS

- a. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences.
- b. Be aware of possible behavioral effects of hazard exposure in authorized entrants.
- c. Continuously maintain an accurate count of authorized entrants in the permit space and ensure that the means used are to identify authorized entrants.
- d. Remain outside the permit space during entry operations.
- e. Communicate with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate.
- f. Monitor activities inside and outside the space to determine if it is safe for the entrants to remain inside the space and order the authorized entrants to evacuate the permit space immediately under any of the following conditions:
 - i. If the attendant detects prohibition
 - ii. If the attendant detects the behavioral effects of hazard exposure in an entrant.
 - iii. If the attendant cannot effectively and safely perform all work.
- g. Assist entry supervisor and entrants as directed by the entry supervisor.
- h. Attendants may have other duties assigned in the area, but must remain within sight or calling distance of the entry supervisor.

5.0 SPECIFIC PROCEDURES

5.1 MINIMUM NUMBER OF EMPLOYEES

A minimum of three employees will be immediately available during all confined space entries. A minimum of one trained employee will be within line sight and verbal communication distance of one another outside of the confined space. A typical confined space team consists of an entry supervisor, an attendant, and entry personnel.

5.2 VENTILATION

- a. Adequate ventilation will be provided to protect employees from dangerous working conditions resulting from accumulations of hazardous concentrations of flammable vapors, toxic gases, or an oxygen deficient or enriched environment in all buildings, pits, rooms, vaults, or other enclosed areas.
- b. If sufficient general ventilation exists to ensure the removal of all atmospheric hazards, as identified through air monitoring, then the space may be treated as an Enclosed Space and only the requirements under section 5.3 of this procedure shall apply.
- c. Note that positive pressure ventilation applied to single entry/exit point may cause potentially contaminated air to come out of the space. Precautions should be taken to prevent workers from being exposed (e.g. run air lines away from area or clear workers from entry point).

5.3 PRE-ENTRY PROCEDURES

a. Lines which may convey flammable, injurious, or incapacitating substances into the space shall be disconnected, blinded, or blocked off by other positive means to prevent the development of dangerous air contamination and/or oxygen deficiency within the space (Consult Lockout/Tagout Policy & Procedures for specific information). The method used shall prevent inadvertent reconnection or disabling of the line.

Exception: This does not apply to public utility gas distribution systems.

Note: This section does not require blocking of all laterals to sewers or storm drains. Where experience or knowledge of industrial use indicates materials resulting in dangerous air contamination may be dumped into an occupied sewer, all such laterals shall be blocked.

- b. Confined space shall be emptied, flushed, or otherwise purged of flammable, injurious or incapacitating substances to the extent feasible.
- c. If air contamination exists, spaces shall be ventilated for at least 15 minutes prior to entry using the most effective method (e.g. blowing air into or drawing air from the space).

d. Where interconnected spaces are blinded off as a unit, each space shall be tested and the results recorded, and the most hazardous condition so found shall govern procedures to be followed.

e. A confined space entry permit (Appendix A) will be completed, signed and dated by a member of the ESO or by a qualified individual designated by the ESO. The original confined space entry permit will be kept on file in the ESO. A copy of the permit shall be kept on file by the department using the permit.

f. An attendant shall be continually present while workers are inside an enclosed or confined space. The attendant may operate the air monitoring equipment.

g. To the extent feasible, all exits and entries shall be readily accessible.

h. All tanks, vessels, or other confined spaces will be entered from the side whenever possible.

5.4 PRE-ENTRY TESTING REQUIREMENTS

a. The air shall be tested with an appropriate device or method to determine whether dangerous air contamination and/or oxygen deficiency exists and a written record of such testing results shall be made and kept at the work site for the duration of the work. Affected employees and/or their representative shall be afforded an opportunity to review and record the testing results.

b. Testing should be performed without disturbing the space, if possible.

c. After long breaks (> half hour) such as lunch, complete testing for permit required confined spaces shall be performed again to determine if any atmospheric changes have taken place inside the confined space.

d. Employees shall refrain from leaning over the area to be tested; instead, the air testing device should be placed over or into the opening of the area.

e. Testing of the oxygen content and testing for flammability (UEL, LEL) shall be documented with sufficient frequency to ensure conformance with this section.

5.5 SPECIAL PRECAUTIONS

a. Work involving the use of flame, arc, or spark, or other source of ignition is prohibited within a confined space (or any adjacent space having common walls, floor, or ceiling with the confined space) which contains, or is likely to develop, dangerous air contamination due to flammable and/or explosive substances.

b. Whenever gases such as nitrogen are used to provide an inert atmosphere for preventing the ignition of flammable gases or vapors, no flame, arc, spark, or other

source of ignition shall be permitted unless the oxygen concentration is maintained at less than 20 percent of the concentration which will support combustion.

c. If the existence of dangerous air contamination and/or an oxygen deficiency is determined by the tests performed, existing ventilation shall be supplemented by the appropriate means.

d. Whenever oxygen consuming equipment is used, arrangements will be made to ensure sufficient venting for all combustion air and exhaust gases.

e. Automatic fire suppression systems employing toxic or oxygen displacing gases or total foam flooding shall be deactivated. If it is not feasible to deactivate these systems, then the use of respiratory protective equipment shall be used during entry into and work within such spaces (SCBA or Supplied Air Respirator with Egress bottle only)

f. Only approved lighting and electrical equipment, in accordance with low voltage electrical safety order, shall be used in confined spaces where dangerous air contamination due to flammable and/or explosive substances exists.

g. Where live electrical work will be performed, the tripod unit will be properly grounded (e.g. welding cable and clamp).

5.6 OPERATING PROCEDURES

5.6.1 Non-Permit Required Confined Space

a. Employees working in non-permit confined spaces shall wear appropriate personal protective equipment appropriate for the hazards expected in the space.

b. Air testing shall be conducted periodically to monitor the pre-existing atmospheric environment and to detect any atmospheric changes that might occur. All testing data obtained shall be recorded on the confined space entry permit.

c. If air sampling instruments indicate a developing adverse atmospheric change (e.g. steadily rising hydrogen sulfide or carbon monoxide levels, or steadily increasing or decreasing oxygen concentration), the supervisor will immediately pull all entrants from the confined space and reassess the area for its new hazard.

5.6.2 PERMIT-REQUIRED CONFINED SPACE

a. All procedures described in Section 5.3 and 5.4 shall apply.

b. An approved safety belt with an attached line shall be used. The free end of the line will be secured outside the entry opening. The line shall be a 900 kg test (2,000 pound) and 11 mm in diameter.

Exception: Where an entry supervisor determines that a safety belt and line would further endanger the life of the employee. Under these circumstances, the harness should remain attached to the employee to facilitate rescue in the event of an emergency.

c. Where air contaminants persist or begin to appear after ventilating a confined space, continuous air monitoring will be performed.

d. When entry must be made through a top opening, the following requirements also apply:

i. A safety belt shall be of the harness type that suspends a person in an upright position will be worn by any person entering the space.

ii. A hoisting device (tripod) or other effective means shall be provided for lifting employees out of the space.

5.7 AFTER HOURS & PRIORITY ENTRIES

a. Under no circumstances is an employee to enter a permit required confined space at UD without following the procedures outlined in this section.

b. In the event that a permit required confined space must be entered after regular working hours, an attempt will be made to contact one of the authorized confined space entry supervisors. If a supervisor is not available, confined space entry may proceed if at least three trained confined space personnel are present and all of the procedures outlined in this document are followed. (The ESO will have a list of all training confined space personnel.)

5.8 EMERGENCY & RESCUE PROCEDURES

a. Should an employee become disabled while in a confined or enclosed space, the attendant shall immediately call the emergency number (x92121 or 911) to summon emergency personnel. It is important to communicate to the dispatchers that a "confined space rescue" is necessary.

b. Rescue attempts shall be made only by individuals who are trained in confined space rescue procedures and that have the necessary equipment to perform the rescue without endangering the safety of the would-be rescuer.

Note: There are no UD personnel trained in confined space rescue. Confined space rescue is the responsibility of off campus emergency agencies.

c. The person attempting the rescue shall be protected by use of a self-contained breathing apparatus (SCBA's) or supplied air respirator (SAR). Ideally, SAR's should be on a pressure line with a minimum length of 25'.

d. For top openings (e.g. manholes, vaults, etc.), a rescue line shall be attached to the rescuer for placement onto the victim for removal from the space. Rescue lines will be affixed to the tripod.

e. An additional positive pressure mask may also be lowered into the space to provide safe air for the victim.

5.9 EQUIPMENT AND MATERIALS

The following equipment and materials will be made available to employees and used when appropriate:

Located in ESO, Alumni Hall 219:

a. Air monitor; Multi Gas MG140 four gas (O₂, H₂S, CO, Combustible Gas).

b. Draeger tubes for various chemicals and gases.

Located in Facilities M&O, ME Building:

c. Harness and life line.

d. Tripod.

e. Forced air device (fan).

Provided as necessary:

f. Appropriate Fire Extinguisher.

g. Chemical Resistive Protective Clothing.

h. Appropriate eye protection.

i. Lockout devices.

6.0 EMPLOYEE TRAINING

6.1 Unless otherwise specified, employees entering confined spaces (entrants), confined space entry supervisors, and attendants must have received all of the training outlined below at the specified time interval from the respective organization. Training shall be provided to each affected employee prior to assigned duties involving confined space operations (see 29CFR 1910.146(g) Training).

a. Respirator Certification (annual, ESO)

b. Fit Testing

i. Applications of Respirators to Different Conditions

ii. Appropriate Cartridge Selection

c. Self Contained Breathing Apparatus (annual, ESO), if applicable.

i. Operation

ii. Fit Testing

d. Confined Space Operating Procedures (Initial and annual, refresher training, ESO)

i. Duties of entrants, attendants, and entry supervisors

ii. Physical & Chemical hazards (H₂S, Flammables, etc.)

iii. Air Monitoring

iv. Operation of Communication Equipment

7.0 RECORDKEEPING AND LABELING

a. A confined space entry permit (Appendix A) will be completed, signed and dated by a member of the ESO or an individual designated by ESO. The confined space entry permit will be forwarded to the ESO and kept on file for a minimum of three years. A copy of the entry permit shall be kept on file by the department to which the permit was issued.

b. Prior to entry, each confined space shall be identified by location and potential known hazards that may be associated with the space. Permit required confined spaces, when identified, shall be appropriately labeled "Danger - Permit Required Confined Space - Authorized Entrants Only", and be assigned a unique identification number.

i. ESO will maintain records of all confined spaces. Information to include location, description of area, anticipated hazards, and unique identification number.

Appendix A: Confined Space Entry Permit

Confined Space Entry Permit

Date and Time Issued: _____ Date and Time Expires: _____
 Job site/Space I.D.: _____ Job Supervisor: _____
 Equipment to be worked on: _____
 Work to be performed: _____

Stand-by personnel: _____

1. Atmospheric Checks: Time _____
 Oxygen _____ %
 Explosive _____ % L.E.L.
 H2S _____ PPM
 CO _____ PPM

2. Tester's signature: _____

3. Source isolation (No Entry): N/A Yes No
 Pumps or lines blinded, () () ()
 disconnected, or blocked () () ()

4. Ventilation Modification: N/A Yes No
 Mechanical () () ()
 Natural Ventilation only () () ()

5. Atmospheric check after Isolation and Ventilation:
 Oxygen _____ % > 19.5 %
 Explosive _____ % L.E.L. < 10 %
 H2S _____ PPM < 10 PPM H(2)S
 CO _____ PPM < 35 PPM CO
 Time _____
 Testers signature: _____

6. Communication procedures: _____

7. Rescue procedures: _____

8. Entry, standby, and back up persons: Yes No
 Successfully completed required training? () ()
 Is it current? () ()

9. Equipment: N/A Yes No
 Direct reading gas monitor - tested () () ()
 Safety harnesses and lifelines for entry and standby persons () () ()
 Hoisting equipment () () ()
 Powered communications () () ()
 SCBA's for entry and standby

Appendix B: 29 CFR 1910.146, Permit-required Confined Spaces OSHA Standard