

# **Confined Space Entry**

#### A. Introduction

Confined space entry requirements are defined in the Washington Administrative Code (WAC), Part 296-809 and University Policy # **POL-U5950.02: CONFINED SPACE.** Applicable definitions are provided at the end of this text in Section Q. A list of WWU confined spaces is available at Environmental Health & Safety.

#### **B.** General Precautions

Employees shall not be permitted to enter atmospheres in a confined space which has contained toxic, flammable or corrosive materials or which may have had such materials accidentally introduced or generated until such space has been evaluated and/or tested by a competent person, generally Environmental Health and Safety staff, who shall declare the space safe for entry. Exposure to temperature extremes, noise, and ionizing radiation shall be controlled.

# C. Confined Space Entry Permit

A confined space entry permit (attached) shall be prepared as described under supervisor responsibilities prior to entry into any permit-required confined space. It shall be kept at the confined space location during the length of the job and shall be in effect for one shift only. Upon execution of the work, the completed permit shall be filed by the supervisor and a copy sent to the Environmental Health and Safety office.

# D. Toxic or Flammable Atmospheres

Atmospheres where contamination is below permissible exposure limits/threshold limit values may be entered without respiratory protection. Atmospheres where contamination is above the permissible exposure limits (PEL) but below values immediately dangerous to life or health (IDLH) may be entered when appropriate respiratory protective equipment is properly worn.

Atmospheres immediately hazardous to life may be entered only in the event of emergency and then only when employees are protected by equipment approved for such exposures. Atmospheres where the toxicity is not known shall require full protection. Entry into spaces which contain or could contain corrosive chemicals or chemicals which are toxic through skin absorption shall require equipment to prevent skin and/or eye contact.

Atmospheres which contain or could contain flammable gases or vapors shall not be entered if the concentration of gases or vapors in any part of the area is more than 10% of the lower explosive limit (LEL) except in the event of emergency and then only when employees are protected by equipment approved for such exposures. It must be remembered that measurements less than 10% of the LEL may still be above the IDLH of some substances.

# E. Oxygen Deficiency or Excess

Atmospheres having an oxygen content less than 19.5% or greater than 23.5% are considered hazardous. Areas with oxygen concentrations below 19.5 shall not be entered without approved respiratory protective equipment which will provide an adequate supply of breathing air. In the event that the air may be diluted by an unknown gas, the atmosphere shall be considered highly toxic and/or flammable.



#### F. Mechanical Hazards

Confined areas containing parts which may move or which contain agitators, fans, or other power driven moving parts of potential hazard to employees shall not be entered until it is assured that such parts cannot move to injure the employee.

The following procedures are applicable if entry involves mechanical hazards. The University's Lockout/Tagout Program for Control of Hazardous Energy shall be followed in confined spaces, as appropriate. Circuit breakers and switches are opened and locked. Fuses are removed or wiring is disconnected and locations are tagged. Belts or mechanical linkages are disconnected and tagged. Parts are physically blocked against movement and switches, clutches or other means of control are tagged. Tagging of controls without other means of control shall be considered satisfactory only if the control is barricaded and/or is under constant observation during occupancy of the space.

#### G. Electrical Hazards

Electrical circuits in the confined area which may present a hazard shall be disconnected, locked out, and tagged in accordance with Western Washington University's Lockout/Tagout Program for Control of Hazardous Energy. All temporary lights shall be protected against damage and cords shall be heavy duty and kept clear of working spaces and walkways. Only low voltage, battery operated, or ground fault protected equipment shall be used on water-sides of boilers or when electrically conductive liquids are involved.

Electric supply circuits, lighting, portable tools, and other equipment used where potentially hazardous concentrations of flammable vapors, gases, or dusts are present or may develop shall conform to the current National Electric Code requirements. Portable electric tools shall be grounded or isolation transformers, ground fault interrupters, or double insulated tools shall be required in such areas.

# H. Procedures Prior To Entry into Confined Spaces Containing Possible Toxic or Flammable Atmospheres

The following procedures are to be followed prior to entry into a confined space containing possible toxic or flammable atmospheres:

- 1. Determine the type and extent of contamination including gases, liquids, sludge, residue, or absorbed material using knowledge of the area.
- 2. Make every reasonable effort to reduce the hazard to safe levels prior to permitting entry into the enclosed space.
- 3. Survey the area to determine the effect of escape of gases or vapors in surrounding areas.
- 4. Post or barricade the area to prevent unauthorized entry.
- 5. Ensure control of all sources of ignition when a potential fire hazard exists.
- 6. Inspect the condition of all required equipment including pumps, ventilating equipment, personal protective equipment, atmospheric testing equipment, and mechanical equipment. Ensure that all equipment is compatible with the work involved.
- 7. Ensure that all entry personnel are trained and familiar with the hazards involved.
- 8. Remove all possible liquid product, sludge, or residue if present by draining, pumping, or washing as applicable. Dispose of solid, liquid or gaseous materials in a manner which will not cause air or water pollution, a fire hazard, or endanger workmen or equipment.



- 9. Vent any pressure as required.
- 10. Isolate any tank or confined space from all potential sources of hazardous (or dangerous) materials by one of the following: (1) remove a valve, spool piece, or expansion joint, cap open the ends, and tag the line; or (2) insert a blank in the line and tag it.

## I. Ventilation in Toxic or Flammable Atmospheres.

Vapor freeing is usually done by ventilation. The effectiveness of ventilation is dependent upon the number of air changes and the efficiency of mixing of the air with the gas in the tank. Ventilation by supply air provides more efficient mixing than exhaust air but cannot be used if it creates a hazard near the discharge point. Exhaust air ducts must be placed at locations remote from air inlets and may require moving to various locations.

Prior to entry, a minimum of five air changes is recommended where oxygen deficiency may exist and ten air changes is recommended where a toxic and/or flammable material is involved.

Concentrations of vapors or gases in the flammable or above the flammable range may require replacement by an inert gas, such as nitrogen or carbon dioxide, to prevent explosions. This situation is highly unlikely at the University; however, if inert gases are used, they must subsequently be replaced by air prior to entry except when the inert gas provides safer working conditions.

All fans and other equipment used for removing flammable gases or vapors shall conform to NFPA requirements and shall not create an ignition hazard. Oxygen shall never be used for ventilation.

## J. Evaluation of Potentially Hazardous Atmospheres.

Evaluation of the atmospheres shall be made by personnel appropriately trained, generally staff in the Environmental Health and Safety office. Atmospheric tests shall be made using accepted procedures and/or instruments to determine the kind and extent of any hazards present. However, atmospheric tests should be supplemented by other types of evaluation.

Evaluation shall consider such factors as degree of toxicity, flammability, oxygen deficiency, noise, temperature, vapor pressures, sorption on surface, sludges, residue, and ventilation rates. Evaluation shall be made immediately prior to entry and during occupation at intervals dependent on the possibility of changing conditions. Testing or other evaluation shall be made in all locations where persons may be exposed. If there is any doubt as to the validity of evaluation, a high hazard shall be assumed to be present, and personal protective equipment or measures used accordingly.

## K. Entry into a Confined Space

After initial removal of any hazardous material potentially present, ventilation of the space (vapor freeing), and testing the atmosphere with accepted procedures and instrumentation, the confined space may be entered to complete cleaning, repair or other work. The following procedures are applicable.

- 1. Respiratory protective equipment shall be used when indicated.
- 2. During business hours (8:00 a.m. to 4:30 p.m) notify FM Work Control Center Dispatch when you enter and include location. Notify again when you leave via radio or phone. After business hours, provide the same notification to University Police Dispatch.
- 3. An observer capable of maintaining communication at all times shall be located outside the confined space. He or she shall have respiratory protection available when indicated.



- 4. If the possibility of a highly toxic or flammable atmosphere, or oxygen deficiency exists or can develop, workers shall wear a safety harness with lifeline attached and a means of rescue shall be provided.
- 5. Fire extinguishing equipment shall be immediately available when indicated.
- 6. Continuous, forced-air ventilation is used prior to entry if needed to eliminate a hazardous atmosphere, and continues until employees have left the space. All work shall stop and the area shall be evacuated if ventilation fails. Ventilating air is to be from a clean source and must not increase the hazard in the space.
- 7. All tools and equipment shall be available as required.
- 8. Emergency lighting shall be available as required.
- 9. The area shall be evacuated if any indications of ill effects such as dizziness, irritation or excessive odors are noted.
- 10. University Police Dispatch shall coordinate call-out of EHS services after-hours to provide confined space monitoring and permitting to entry personnel.

#### L. Hot Work

The following procedures are applicable if hot work is performed in a confined space:

- Any hot work involving sources of ignition and including welding and burning shall require
  positive assurance that fire hazards and flammable atmospheres have been controlled.
  Combustible material shall be protected.
- Usually the atmosphere is tested by a combustible gas indicator and/or other device as indicated. Tests are made frequently enough during work to assure that safe conditions prevail.
- 3. A hot work permit is required prior to beginning hot work.
- 4. Where hot work involves the generation of toxic gases, vapors, or fumes, local exhaust and/or respiratory protection shall be required.
- 5. Compressed gas cylinders should not generally be allowed in confined spaces. Compressed gas lines shall be protected from rupture or damage.
- Compressed gas cylinders or electric generators should be attended at all times. Sources of compressed gases or arc welding power shall be turned off immediately when an emergency arises or when work is interrupted or completed.

# M. Use of Toxic and/or Flammable Materials in Confined Spaces

Work in confined spaces may require the use of toxic or flammable materials. These include but are not limited to coatings, linings, paints, cements, and solvents. Quantities of toxic or flammable materials brought into or used in confined spaces shall be limited to the smallest amount consistent with efficient use. Containers shall be designed to minimize evaporation and spillage. Safety cans or small squeeze bottles are preferable when applicable. Spraying of toxic or flammable substances such as paint is not recommended.

Continuous ventilation shall be provided in sufficient quantity and design to control fire and health hazards. Atmospheres shall be tested and/or evaluated to provide positive assurance that hazards do not exist. In no instance shall flammable vapor concentrations exceed 10% of the lower explosive



limit. Evaluation shall be repeated at intervals to ensure no hazardous build up of concentrations.

Respiratory protective equipment shall be used as appropriate. Sources of ignition shall be eliminated when flammable liquids are used. Materials, equipment, and training shall be provided to clean up spills. All applicable instructions or recommendations from the manufacturer shall be employed.

## N. Emergency Response/Injured Person Removal and Assistance

Notify University Police Dispatch at x3911 to activate the Confined Space Rescue Team. University Police Dispatch will activate other emergency services.

If a telephone is not easily accessible, Facilities Management personnel radio the Work Control Center. Ask the base radio operator to notify Public Safety at x3911.

Stay at the site until emergency assistance arrives. If possible, remove the injured worker via the emergency removal equipment, and the harness and line. Under no circumstances shall the attendant enter the confined space unless trained in confined space rescue. Provide first aid as possible and necessary. Do not attempt to move or remove an injured worker unless it can be done safely. Emergency rescue by University employees follows procedures in WAC, Part 296-809.

After any job-related accident, file an accident report with the Environmental Health and Safety office, Environmental Studies Building Room 72, 650-3064.

## O. Training

All employees required to enter into confined spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, emergency procedures, the permit system, and in the use of protective and emergency equipment required. All training shall be documented. Training relating to other safety programs including respiratory protection, lockout/tagout, hot work, first aid, and CPR may also be required of employees prior to confined space entry.

WWU Confined Space Rescue Team members are required to attend regular trainings as outlined in the Confined Space Rescue Team Charter in Appendix 15-1.

#### P. Contractors

Any contractor of the University working in a confined space must have a written confined space program. A copy shall be provided to the University prior to confined space entry. Training of contractor employees shall have been performed and copies of training documentation shall be made available upon request.

A department retaining a contractor for work in a confined space shall inform the contractor of any potential fire, explosion, or health and safety hazards reasonably ascertainable within the confined space. The department representative shall inform the contractor of the University's confined space program and other applicable safety procedures, including emergency response procedures.

#### Q. Definitions

- **AIR CHANGE** refers to replacement of the entire volume of air in a room or space with an equal volume of fresh air.
- **CONFINED SPACE** means any space having a limited means of egress which is subject to the accumulation of toxic or flammable contaminants or an oxygen deficient atmosphere. Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers,



ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, attic spaces less than 6 feet high or higher with only one entry point, pipelines and open top spaces more than 4 feet in depth, such as pits, tubes, vaults and vessels.

- **CONFINED SPACE ENTRY PERMIT** is the University's authorization for entry under defined conditions into a confined space.
- **FLAMMABLE ATMOSPHERES** are atmospheres in excess of 10% of the lower explosive limit. These are usually toxic as well as flammable.
- **HOT WORK** is the performance of work involving burning, welding, riveting, or similar fire-producing operations as well as work that produces a source of ignition, such as drilling, abrasive blasting, and space heating.
- **HOT WORK PERMIT** is a permit completed prior to initiating hot work.
- **IDLH is IMMEDIATELY DANGEROUS TO LIFE AND HEALTH** and represents a maximum concentration from which one could escape unaided without any escape-impairing symptoms or irreversible health effects.
- **LEL** is the **LOWER EXPLOSIVE LIMIT** which represents the minimum concentration of a combustible gas or vapor in air, usually expressed in percent by volume at sea level, that will ignite if an ignition source with sufficient ignition energy is present.
- OXYGEN DEFICIENT/ENRICHED ATMOSPHERES. Oxygen deficient atmospheres are deemed to exist if the atmosphere at sea level has less than 19.5% oxygen by volume or has a partial pressure of 148 millimeters of mercury or less. Factors such as acclimatization, physical condition of persons involved, etc., must be considered for such circumstances and conditions. Oxygen enriched atmospheres are over 23.5%.
- **PERMISSIBLE EXPOSURE LIMIT** is the maximum eight-hour time-weighted average of an airborne contaminant to which an employee may be exposed.
- **TOXIC ATMOSPHERES** are atmospheres having concentrations of airborne chemicals in excess of permissible exposure limits.

# **Confined Space Entry Permit**

Date	Complete this form prior to Time	mplete this form prior to entering any permitted confined space. Keep on site. Good for one shift (8 hrs from time listed) only.  Time Location of Confined Space Trade(s) Involved   Shop Supervisor									
Outside Contractor Involved in Work					Shop Su	pervisor					
Outside Contractor Involved in Work Shop Supervisor Equipment to be worked on Work Performed											
Qualified Entry Personnel					Qualified Back-Up Personnel						
Initial atmospheric check:				Time		Equipment Pr	ovided	NA	YES	NO	
Meter used:		Oxygen >19.5-<23%				2-way radio					
☐ Biosystems Multipro Gas Detector		LEL <10 %				Flashlight					
☐ Biosystems PhD Plus		CO < 35 ppm				Line					
☐ Calibrated ☐ Bumped same day		H2S <10 ppm				Harness					
Testing performed by:			·	- 1			Rescue tripod				-
		NA YES NO			Fire extinguisher						
Source Isolation (Lock out/Tag Out)							Protective suit				
Pumps/lines blinded/disconnect/blocked							Gloves				
Natural ventilation present							Hard hat				
Mechanical ventilation required							Boots				
Atmospheric check after ventilation				Time		SCBAs □ e	entry 🗆 backup				
CO < 35 ppm		Oxygen >19.5-<23%			Respirator □ entry □ backup						
H2S <10 ppm		LEL <10 %			Assured Equip Ground Required						
Performed by:						Hot work	permit Required				
Site Hazards, e.g. trip, fall:					Periodic Atmospheric Testing						
Chemical Hazards (list if any):						Time			Tin	ne	
		NA	YES	NO		Oxygen >19.5-<23%		Oxygen	1>19.5-<23	%	
Emergency notification (call base radio)						LEL <10 %			LEL <10	%	
Rescue procedure available						CO < 35 ppm			CO < 35 pp	m	
Emergency lighting present						H2S <10 ppm		]	H2S <10 pp	m	
For additional comments, use the margin or page back. Return a copy to the EHS Office, MS 9070, Env. Studies Rm 72. Job Supervisor files original.  I have reviewed the work authorized by this permit and the information in it. Written instructions and safety procedures have been received and understood. I know that I can and should stop the job, evacuate the space, and contact EHS if safety concerns arise or if conditions change.											
Preparer Signature (EHS staff/competent person)Approval Signature (job supervisor)											
Rev 0. 7/21/92 Rev 1. 9/17/92 Rev 2.7/15/98 Rev 3.12/15/06 Rev 4. 12/19/07											

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Western Washington University

Back of Permit Form



## Procedures for Entering and Working In the University's Tunnel System

Tunnels where hazardous materials are used or generated or hot work is performed <u>ARE</u> permit-required confined spaces.

- Whenever possible create two **OPEN EXITS**, by opening manholes from the outside and putting up a barricade or opening locks on doors at the other end of the tunnel.
- Carry a two-way radio with the Facilities Management (FM) Base frequency or a cell phone. During business hours (8:00 a.m. to 4:30 p.m.) notify FM Work Control Center Dispatch when you enter and include where you will be going. Notify again when you leave via radio or phone. After business hours, provide the same notification to University Police Dispatch.
  - o Telephones located in the tunnels are available for use in emergency.

In non-permitted confined spaces, a person may enter alone ONLY for inspection, lamp replacement and cleaning without hazardous material type cleaners. All other maintenance and repair work requires a second person as a buddy.

**Only in a permit-required confined space:** An attendant remains outside the tunnel monitoring the ventilation system.

- 1. Carry a flashlight for lighting in the event of power failure.
- 2. Provide lockout/tagout of hazardous energy, including water or steam, and emergency lighting if needed. Call EHS for hazard assessment prior to starting work. These situations may or may not be permit required.
- 3. Air monitoring is required. Contact EHS for monitoring or a determination providing otherwise.
- 4. Ventilation (a fan supplying air) is required in certain circumstances.
- 5. Complete the confined space entry permit prior to entering the confined space segment of the tunnel.
- 6. Rescue team (5 members minimum) available. If after-hours entry is needed, EHS evaluates need for rescue team presence prior to entry.
- 7. When hot work is performed, it is done in accordance with hot work permit procedures and a permit is prepared.
- 8. When toxic materials are used in tunnels, consultation with the Environmental Health and Safety staff must occur well in advance of entry.
- 9. University Police Dispatch shall coordinate call-out of EHS services after-hours to provide confined space monitoring and permitting to entry personnel.



## **Confined Space Procedures for the University's Vessels**

This procedure is applicable to boilers and other vessels present on the University campus. Because a lack of oxygen may be present, these are considered to be confined spaces. When it has been decided to enter a confined space, contact the Environmental Health and Safety office to arrange for air quality monitoring. This should be done at least one day prior to entry.

- 1. Drain the vessel.
- 2. If the vessel has not contained water, but has contained a toxic material, contact the Environmental Health and Safety office for specific procedures.
- 3. Open all ports and entries to the vessel. Allow air to move freely through the space. At least 5 air changes must occur prior to entry.
- 4. Monitor the air quality within the vessel. If the oxygen level is adequate and there are no flammable or toxic materials, entry is acceptable.
- 5. If flammable or toxic materials are to be used, consultation with the Environmental Health and Safety staff must occur well in advance of entry.
- 6. Continuous ventilation is required only if one port is present on the vessel. If two ports are present which can function as exits, the space is not a permit-required confined space.
  - If hazardous materials are used or generated within the vessel as in cleaning or painting operations, or if hot work is performed, vessel is considered a confined space. Refer to procedures in Number 9 below.
- 7. One person is present outside the vessel as an attendant at all times. The attendant shall be trained in initiating rescue.
- 8. Prepare the confined space entry permit and sign off prior to entry.
- 9. Provide lockout/tagout of hazardous energy, including water or steam, and emergency lighting if needed. If hot work is performed, it is done in accordance with hot work permit procedures and a permit is prepared. If toxic materials are used in the space, consultation with the Environmental Health and Safety staff must occur well in advance of entry.



# **Confined Space Procedures for Other Mechanical and Electrical Spaces**

All air handling units when accessing area with unprotected moving machinery are permit required confined spaces.

Filter banks are NOT permit-required confined spaces.

All underground electrical vaults and personnel-access holes are permit-required confined spaces.

The mechanical and electrical spaces below are considered permit-required confined spaces.

When it has been decided to enter a confined space, contact the Environmental Health and Safety office to arrange for air quality monitoring. Whenever feasible, this should be done at least one day prior to entry.

The following procedure is applicable:

- 1. Assemble and inspect all rescue equipment, harness, line, emergency or temporary lighting, if necessary, first aid kit, radio, ventilation, protective equipment, including gloves, suits, boots, hard hats, etc, respiratory protection, traffic control devices, and take to site.
- 2. Prevent unauthorized entry. Generally no special procedure is required, since spaces have limited access.
- 3. Ventilate the confined space area, if needed.
- 4. Monitor the air quality within the space. If it is acceptable, continue with entry procedures including notification to FM Work Control or University Police. If hazardous levels are present, consult with EHS staff prior to continuing the entry program.
- 5. Provide ventilation during entry into the space, as needed.
- 6. Complete the confined space entry permit. Complete hot work permits.
- 7. Monitor air quality during entry, if appropriate, based upon the potential for hazardous or flammable gases and changing work environments. This will be determined by a competent person, generally the Environmental Health and Safety staff.



#### Appendix 15A-1

#### **Confined Space Rescue Team Charter**

#### **Background and Policy**

As of August 1, 2009, the Bellingham Fire Department eliminated their technical rescue program, including confined space rescue services. Western developed an approach to fulfill the requirements of WAC 296-809 Confined Spaces, by forming a rescue team to provide adequate rescue and emergency services for individuals, Western employees and its contractors, working in permit-required confined spaces. The Confined Space Rescue team reports to the Environmental Health and Safety (EHS) Director.

#### **Confined Space Rescue Team Composition**

The team is comprised of approximately sixteen members. The program must have a minimum of five team members available during all business hours. In order to accomplish this with regularly scheduled work and accounting for personal leave taken, it is prudent for the team to have sixteen members. The majority of the team members are Environmental Health and Safety (EHS) and Facilities Management (FM) staff. Individuals from other departments on campus can be considered as members. In all cases, careful review of a candidate's qualifications is performed in order to select an individual best suited to perform the essential functions of the expected work.

#### **Confined Space Rescue Team Functions**

The function of the confined space rescue team is to provide technical emergency rescue requiring entry into a confined space. The confined space team may respond to emergencies other than in confined spaces that require their specialized training and equipment. Response to these situations will be determined by the EHS director or designee.

Level of response will include careful review of the team's familiarity with the non-confined space location, hazards they may encounter, entry and exit means for the location, type of rescue equipment and personal protective equipment (PPE) needed and that the operation is within the scope of the team's training and experience.

#### **Medical Evaluation**

Prior to admittance and participation on the confined space rescue team, an individual must undergo a medical evaluation in order to determine that physical and mental requirements are met. The EHS Department manages the medical evaluation scheduling and contract with the local provider.

#### **Training and Attendance**

All members of the team must be trained and certified in Cardiopulmonary Resuscitation (CPR) and First Aid. EHS schedules one four-hour confined space rescue training once a month. Trainings consist of learning techniques and use of equipment for technical rescue and entering confined spaces on

Western's campus. Practice drills in confined spaces on Western's campus and pre-planning are also a component of regularly scheduled trainings. All members of the team are expected to attend at least nine out of the twelve training sessions per year.

#### **Membership**

Team members are interviewed and selected based on required and preferred qualifications as well as postprobation status.

## **Term of Membership**

Term of membership is for the duration of employment at Western. If a member is external to EHS, the individual may choose to discontinue service for undisclosed reasons. Confined Space Rescue Team leadership also reserves the right to excuse members based on reasons of merit.