

UNIVERSITY OF WASHINGTON

Confined Space Entry Program

ENVIRONMENTAL HEALTH & SAFETY
GS-05

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I. Overview

This document contains a campus-wide Confined Space Entry Program for the University of Washington. Its purpose is to assure worker safety and prevent personal injury from work in confined spaces.

The Washington Administrative Code 296-62 Part M (Confined Spaces) stipulates that prior to entry into a confined space the following requirements must be met:

- a written confined space entry program must be developed and enforced;
- employees must receive training on safety in confined spaces;
- hazards must be controlled;
- certain backup precautions must be available.

The University has established a campus-wide confined space entry program to meet these requirements. This document establishes department responsibilities, contains guidelines to assist the departments in implementing these responsibilities, and addresses the training aspects of the program.

A. Program Scope

These policies and procedures cover all University employees, including hourly and temporary who enter a confined space to perform assigned work and those who supervise or assist during confined space entry operations.

B. Program Implementation

The implementation date for the Confined Space Entry Program is October 30, 1994. EH&S is working with affected departments to identify confined spaces on campus, provide training and develop compliance programs at the department level.

C. Responsibility

1. Environmental Health and Safety is responsible for assuring that an confined space entry program is established on campus that provides maximum employee protection and complies with state industrial safety and health regulations. In doing so, Environmental Health and Safety produces and maintains program documentation including a written program description, establishes program standards, advises departments on compliance and provides employee training. EH&S will also audit departments for compliance with the program during its routine and special inspections.

2. Employing departments are responsible for implementing the confined space entry program for their employees who enter or assist those who enter confined spaces. Supervisors must assure that the procedures are followed whenever employees enter a confined space.
3. Employees are required to follow prescribed safety practices and procedures and use appropriate personal protective equipment when entering a confined space.

D. Definitions

Confined Space means a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit; and
- Is not designed for continuous employee occupancy

Permit Confined Space (Permit Space) means any confined space that has one or more of the following characteristics:

- Contains, or has a potential to contain a hazardous atmosphere;
- Contains a material that has a potential for engulfing an entrant;
- Has sloping walls or a floor that could trap or suffocate an entrant; or
- Contains any other serious safety or health hazard such as:
 - moving machinery,
 - loud noise,
 - high radiation,
 - exposed high voltages,
 - temperature extremes.

Non-Permit Confined Space means a confined space that has no hazards or potential hazards in it.

Note: A non-permit space may become a permit space if work that releases toxic materials into the air, such as welding or painting, is done in it.

Environmental Health and Safety (EH&S). The University department that deals with safety and environmental issues.

Ground Fault Circuit Interrupter (GFCI). A device which shuts off electricity if there is a short to ground.

Immediately Dangerous to Life and Health (IDLH). Any condition that poses an immediate or delayed threat to life or that would cause permanent health effects or would interfere with a person's ability to escape unaided from the confined space.

Lower Explosive Limit (LEL), The lowest concentration of a flammable gas in air that will explode.

Permissible Exposure Limit, Maximum allowed amount of exposure to a toxic substance.

Personal Protective Equipment (PPE), Equipment that is worn by a worker and provides protection to that worker only, such as gloves, safety glasses and steel toe shoes.

Self-contained Breathing Apparatus (SCBA), The type of respirator provided with air tanks.

Upper Explosive Limit (UEL), The highest concentration of a flammable gas in air that will explode.

Washington Industrial Safety and Health Administration (WISHA), The Washington agency responsible for workplace safety, a division of the Department of Labor and Industries

II. **Confined Space Entry Program Elements**

A. **General Administrative Requirements**

1. **Permits**

A written permit is required for entry into permit spaces. The permit form is in the appendix of this document. The permit must be signed by a supervisor or lead who has taken the Environmental Health and Safety Confined Space training.

Permits are valid until the job listed in the "Purpose of Entry" section on the permit is completed. Signed permits must be kept on file for thirty years in the department authorizing the entry.

2. Signs

All permit confined spaces at the University must be labeled with a sign as designated below. Departments controlling the spaces are responsible for posting these signs. If a department can not label a space, it must consult with EH&S about an alternative method of protection.

Danger

Follow confined space entry
procedure before entering.

or

Danger

Confined space
Enter by permit only.

3. Pre-entry Checklist

Use the **Confined Space Entry Permit**, the **Lockout Checklist** and the **Confined Space Hot Work Permit** for a pre-entry checklist. The permits are in Appendix C of this document and the checklist is in Appendix C of the Lockout program.

4. Accident/Incident Reporting

Use the standard University accident/incident reporting forms to report problems that occur during an entry. If there is a death or several people are seriously hurt contact EH&S and the Washington Department of Labor and Industries at 281-5470.

5. Periodic Inspections and Record Keeping

Supervisors must periodically monitor the confined space entries done by personnel under their supervision. Records of this monitoring and the permits themselves will be kept by the department in a central place.

B. Equipment and Personnel Requirements

1. Hazardous Atmospheres

The air in confined spaces may be dangerous. Confined spaces frequently contain flammable or toxic gases or may not have enough oxygen.

Oxygen Level

Oxygen can be removed from the air by bacterial growth, rusting, or displacement by another gas. An atmosphere with too little oxygen won't support life. Too much oxygen is a fire hazard.

Fire

Flammable gases and liquids may cause fire and explosion in a confined space. Combustible dusts in the air can present the same hazard.

Toxic materials

Toxic atmospheres may be present in a confined space because of chemicals stored there, or they may be created by chemical reactions or bacterial growth.

2. Lockout/Isolation

All confined spaces must be isolated from hazardous energy sources following the University's Lockout policy.

3. Personal Protective Equipment (PPE)

When respirators are used inside a confined spaces they shall be used in compliance with the University's Respiratory Protection Program.

Use appropriate gloves for the hazard. Chemical resistant gloves must be selected for the specific substance used because some chemicals can penetrate unsuitable glove material. Change gloves used for chemical

protection often. See the Laboratory Safety Manual or contact EH&S, Industrial Hygiene and Safety section (3-0467) for glove selection.

Safety Harnesses

Harnesses are designed to remove a person who becomes disabled while in a confined space. The injury may or may not have anything to do with the space itself. Harnesses also provide protection against engulfment hazards, such as occur in silos. A harness with an attached rescue line must be used in all entries unless the line causes more hazard than it eliminates. EH&S must approve all entries without a rescue line.

Use a harness appropriate to the task and type of space. This may be a simple waist belt, a chest harness, wrist harness, or even an ankle harness. The harness used must be suitable to pull the person out of the space. Usually, a full body harness, such as those used for fall protection, is sufficient.

If entry is from the top of the space, a lifting device, such as a tripod with a winch, is needed to haul the person out. The device must be in place before anyone enters the space

Safety harnesses must be worn in each confined space entry unless a variance is obtained from EH&S.

Other personal protective equipment needed in a confined space may include:

- chemical protective clothing
- safety shoes
- hard hats
- safety glasses
- hearing protection

4. Special Equipment

All electrical equipment used in a confined space must be low voltage (less than 50 volts) or protected by a ground fault circuit interrupter.

Air driven equipment will decrease the fire hazard, but it does not eliminate overheating, sparking from grinding, percussion or static electricity.

If there is a hazard of explosions, use non-sparking tools and explosion-proof lighting. Contact EH&S before entering a space with a potentially explosive atmosphere.

C. General Training Requirements

Each person who enters a confined space, who trains others in confined space entry techniques, authorizes or supervises entries, or who acts as a standby during entries must receive EH&S approved training. The training must reflect the policies in place at the time of the entry and be provided before the entry. Trainees must demonstrate competency of the tasks required before the training is complete.

Topics covered by the training must include:

- Entry and exit procedures
- Air monitoring
- Safety equipment use
- Lockout/Isolation
- Rescue
- First Aid/CPR
- Permits
- Fire Protection (Hot Work)
- Communication
- Respirators
- Purging/Ventilation
- Heat Stress

* Other University policies apply.

Environmental Health and Safety will provide or approve all Confined Space Safety training.

See Appendix B for training course descriptions.

D. Basic Confined Space Entry Procedures

1. Ventilation

All confined spaces must be ventilated before entry. Blow in a volume of fresh air equal to at least five times the volume of the space. If there could be toxic gases or vapors in the space, blow in ten times the volume. Know the flow rate of the ventilator and the volume of the

space to calculate the number of air changes.

To get the minimum time the ventilator should operate before entry, divide the volume of the space by the flow rate of the fan. Multiply that by the number of air changes required.

Continue to ventilate the space as long as there is anyone in it. The ventilation system should have a failure alarm on it. Everyone must leave the space if the ventilation fails.

Examples of ventilation systems:

- elephant trunks
- venturi eductors
- compressed air

Ventilation systems should be explosion proof if there is a possibility of flammable gases. Venturi eductors (also called air horns or air ejectors) and compressed air are explosion proof, but they are also noisy and move air slower than elephant trunks.

Never use oxygen for ventilation. It increases the fire hazard. Always push air into confined spaces when ventilating them. This is especially important in sewers to avoid pulling contaminants from other areas of the sewer.

If work which creates a breathing hazard (e.g., welding) is being done in the space, use a local exhaust system to capture the toxic vapors before they get into the general air of the space. Keep the exhaust intake close to the work to ensure it captures all the gases.

Make sure the ventilation replaces all the air in the space. Don't allow dead air spaces. You can test for this with a smoke tube.

If the space has been steam cleaned, let it cool before entry. If the space may contain combustible gases, ground the steam nozzle to prevent static buildup. Don't steam the space if the auto-ignition temperature of the contaminant is less than 120% of the steam temperature.

2. **Air Testing**

The air in confined spaces should be tested for toxicity, oxygen deficiency or excess, and explosivity before anyone enters. Air testing is

generally done by Environmental Health and Safety, Industrial Hygiene and Safety Section. EH&S will at its discretion train other employees in air testing techniques. Employees outside of EH&S may only do testing as they were trained. They may not use equipment that was not covered in their training. Call EH&S to arrange testing.

The maximum allowable amount of air contaminants in the space is available from EH&S. These limits are the same as those that apply to the general workplace. Confined spaces with levels above these limits may be entered if respiratory protection is used. However, levels that are immediately dangerous to life or health (IDLH) may only be entered if someone's life or health is at risk. The limits are not a line separating "Safe" from "Unsafe." Do what you can to keep the level of contaminants as low as you can.

Oxygen levels should be between 19.5% and 23.5%. Lower levels may be entered if an air supplied respirator is used. Do not enter areas with an oxygen level above 23.5%.

Never enter an area with a concentration of flammable gases or vapors greater than 10% of lower explosive limit (LEL). Combustible dusts are dangerous when you can't see more than five feet. If flammables can not be controlled, the atmosphere can be rendered inert by adding nitrogen. Contact EH&S before doing this.

Test equipment is specific. Before selecting the equipment to measure possible concentrations of materials, you need to know what chemicals could be in the space. The equipment used depends on substance.

Initial testing of a confined space should be done from outside. A long hose or fishing rod can be used to reach inside without actually entering.

Testing should be done at several levels since gases can form layers.

Examples:

- Solvents are 3 to 10 times heavier than air.
- Hydrogen and methane are lighter than air.

Testing should be done after the space has been ventilated. Three tests should be done 5 minutes apart. You may enter to test remote areas which cannot be tested from outside only after the initial ventilation and testing of the areas accessible from the entry point(s).

Continuous testing should be done if the atmosphere can change.

Examples:

- welding ● painting ● descaling
- cleaning with chemicals ● sewers
- desorption from walls (liquid propane)

If you are doing continuous testing, set the meter's alarm limits as listed in the table below. If the low alarms go off on flammability, carbon monoxide or hydrogen sulfide stop the work you are doing and fix the problem. If any of the other alarms go off you must evacuate the space.

Alarm Limits

Oxygen (O₂): low 19.5% - high 23.5%

Flammability: low 5% - high 10%

Carbon Monoxide (CO): low 35 ppm - 75 ppm

Hydrogen Sulfide (H₂S): low 10 ppm - high 15 ppm

3. Entrance Attendant

A person must be stationed outside the confined space whenever there is someone in it. This person must stay in constant communication with each worker in the space. Communication can be by voice, 2-way radio, or by a wired system. Radios may not work underground so other arrangements must be made.

The entrance attendant must order the space evacuated if there is any doubt about safety of the space or if the ventilation system fails. The attendant must also have the workers leave the confined space if he or she detects any unusual behavior or illness in entrants (toxic effects). The entrance attendant must also be able to summon help in an emergency without leaving the entrance.

4. Entrance Safety

The entrance to the confined space should be barricaded if there is a possibility of someone falling in. Access hatches should be blocked or tied open so they can't close accidentally, trapping workers inside.

5. Special Work Practices

Hot Work

A hot work permit is required for doing work such as welding cutting or burning in a confined space. A copy of the required permit is in the appendix.

If an oxyacetylene torch is being used, the cylinders must remain outside the space. Also, to avoid leakage, remove the hoses when not in use.

Hot work releases toxic gases and fumes; special ventilation and air testing is required.

Sewers

Sewers cannot be completely isolated and there is no way to know what might have been poured into them. Therefore a 10 minute escape respirator shall be carried by each person who enters a sewer. If there is the possibility of flooding during a sewer entry, all entrants must wear an automatically inflatable personal flotation device (PFD).

6. Emergency Procedures

Most of the people who die in confined space incidents are rescuers. A safe rescue requires special equipment, training and an immediate response. The UW does not have the capability to provide this. Therefore, no UW employee is authorized or expected to try to rescue someone from a confined space. EH&S has made arrangements with the Seattle Fire Department for confined space rescues. If there is an emergency in a confined space, the following 3 rules are important:

1. Call fire department. Tell them it is a "Confined Space Emergency."
2. Immediately provide ventilation in the space. If it occurs on campus, the FOMS (facilities operations maintenance specialists) in physical plant have ventilators on their truck. They can be

contacted by the UW police or the Physical Plant communications center (the "com center").

3. Assume the atmosphere in the confined space is poisonous. Do not enter it.

E. Contractors

Departments that hire contractors to do work in confined spaces shall notify the contractor of the requirements for confined space work before letting the contract. The department shall inform the contractor of the specific hazards of the spaces they will work in. When contractors are working with UW employees in a confined space, They will coordinate their program with this one. Contractors who do not have a program shall not perform work on UW property.

F. Further Information

Contact EH&S, Industrial Hygiene and Safety Section at 543-7388.

UW Operations Manual Policy

All employees, students and their supervisors who enter hazardous confined spaces in the course of their work at the University of Washington shall be trained in safe procedures for these entries by Environmental Health and Safety (EH&S). All these entries shall be done following the procedures provided by EH&S.

Departments that control hazardous confined spaces shall ensure they; are locked, can only be opened with a tool or are posted with a sign with EH&S approved wording.

Contractors shall ensure their confined space entry program meets the requirements of the UW program.

A hazardous confined space means a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit; and
- Is not designed for continuous employee occupancy

and has one or more of the following characteristics:

- Contains, or has a potential to contain a toxic and/or hazardous atmosphere;
- Contains a material that has a potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or a floor that slopes downward and tapers to a smaller cross section; or
- Contains any other recognized serious safety or health hazard such as:
 - moving machinery,
 - loud noise,
 - high radiation,
 - exposed high voltages,
 - temperature extremes.

Examples:

- sewers ● lift stations ● storage tanks ● boilers
- tanks ● hoppers ● vessels ● silos ● diked areas

- storage bins
- vaults
- excavations
- pits.¹

¹The utility tunnels on the main campus are not normally hazardous confined spaces. However, if work that releases toxic materials into the air, such as welding or painting is done in them they may become confined spaces.

Training

The success of a department's confined space entry program depends on supervision by trained and qualified personnel.

Target Audience

All employees who:

- enter a confined space, or
- approve entry into a confined space, or
- supervise work in a confined space, or
- act as an entry attendant during the entry,

shall receive training in confined space entry techniques. Employees must receive training from Environmental Health and Safety.

Instructional Goal: To assure the proper supervision of all confined space entry operations at the University of Washington.

Behavioral Objectives: Employees completing this training will:

1. Be familiar with the UW policies and procedures relating to confined space entry and know where to obtain a copy of the written documentation for the program.
2. Understand what circumstances constitute entry into a confined space.
3. Be able to identify, document, and correctly post confined space locations in areas under their control.
4. Know the procedures to follow to issue a permit for confined space entry.
5. Know how to identify an emergency situation, order evacuation of the space and notify emergency personnel.
6. Be able to communicate the requirements of the UW Confined Space Entry Program to others and explain procedures or conditions such as:
 - Lockout
 - Hazardous Atmosphere
 - Ventilation

- Air Testing
- Entry Procedures (including entrance attendant and communication requirements)
- Personal Protective Equipment Requirements
- Hot Work Situations
- Special Equipment Requirements
- Emergency Procedures



UNIVERSITY OF WASHINGTON
CONFINED SPACE HOT WORK PERMIT
 ENVIRONMENTAL HEALTH AND SAFETY

This permit must be completed and signed by all employees prior to entry into a confined space.

WELDING/CUTTING/OPEN FLAME

Type of Hot Work	Project or Work Order Number	Start Up Date	Expiration Date	Today's Date
Job Supervisor	Phone Number of Job Supervisor	Location of Job		
Person Performing Hot Work		Name of Fire Watcher		

- All welding/cutting/open flame equipment is in good repair.
- A minimum 4A 60BC fire extinguisher (10 lb. ABC) is in the work area until the project is completed.
- Verify the atmosphere is free of flammable vapors.
- Remove all flammable and hazardous materials within 35 feet of the site.
- All combustibles within 35 ft. relocated or covered with a flame retardant material when cutting and welding, (10 feet for other open flame operations).
- Combustible walls are protected.
- Combustible floors are wet down, covered with wet sand, or suitable shield.
- Openings or cracks in walls, floors and ducts are tightly covered with noncombustible material.
- Pipes or other metal that penetrates walls are protected with noncombustible material.
- Conveyor systems are covered with noncombustible material.
- Nearby personnel are protected from heat, sparks, slag and intense UV light.
- Sprinkler system is in service.
- Sprinklers and fire alarm equipment are protected from false discharges and alarms.
- Trained fire watcher is on location during work and for 1/2 hour after.
- OK to start work.
- Fire checks are made on half hour intervals for 4 hours after completion of work.

1/2 HOUR FIRE CHECKS

Hot Work Starting Time:	<input type="checkbox"/> AM <input type="checkbox"/> PM	Initials of Fire Watcher:								
Hot Work Finishing Time:	<input type="checkbox"/> AM <input type="checkbox"/> PM	Enter Time of Check:								

- Protection is removed from sprinklers and fire alarm equipment (at end of job).

HOT WORK COMPLETED

Signature of Job Supervisor _____

Date of Signature _____

DANGER

CONFINED SPACE

ENTER BY

PERMIT ONLY

DANGER

**FOLLOW CONFINED
SPACE ENTRY
PROCEDURE BEFORE
ENTERING**