Confined Space Entry Program
Confined Space Entry

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Environmental Health & Safety, Washington University in St. Louis, Campus Box 1010, One Brookings Drive, St. Louis, Missouri 63130-4899, (314) 362-6816, Fax (314) 935-9266, http://ehs.wustl.edu
Confined Space Entry Program

I. INTRODUCTION

The purpose of this program is to ensure the protection of all Washington University employees from the hazards associated with confined space entry. This document contains requirements for practices and procedures to protect employees from hazards within permit required confined spaces. This is the official policy of Washington University - St. Louis.

II. RESPONSIBILITIES

A. Washington University - St. Louis, Environmental Health and Safety (EH&S) shall be responsible for the following:

1. Development, documentation an administration of the written Confined Space Program and revise the program as necessary in accordance with the Federal Occupational Safety and Health administration (OSHA), Permit-Required Confined Spaces (29 CFR 1910.146).

2. Provide guidance for the proper selection and use of appropriate equipment and personal protective equipment to meet the requirements of this program.

3. Periodically audit work operations and documentation to evaluate the overall effectiveness of the confined space entry program and ensure that employees participating in entry operations are protected from permit space hazards.

4. Assist each Supervisor in identifying confined spaces encountered by his/her employees.

5. Provide awareness training on confined space entry and maintain training records.

6. Provide instruction to personnel on the proper use of equipment required for confined space entry.

7. Review permits that are held for one year, document and address any problems with Departmental Supervisors.

B. Supervisors shall be responsible for the following:

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1. Identifying and reporting job areas and locations that are possibly confined spaces. A list of confined spaces that are identified shall be submitted to EH&S

2. Classifying confined spaces as "permit required" or "non-permit required".

3. Identifying personnel who will enter confined spaces.

4. Evaluating and measuring respiratory hazards or advising personnel on routine measurement of respiratory hazards in confined spaces.

5. Conducting work site inspections to review unit compliance with confined space entry procedures.

6. Maintaining records of equipment maintenance and employee training.

7. Issuance and cancellation of entry permits.

8. Identifying and evaluating the hazards of permit spaces before employees enter them.

9. Conducting a pre-entry briefing to inform entrants of possible hazards that may be encountered in a confined space.

10. Taking necessary measures to prevent entrance into prohibited permit spaces.

11. Informing outside contractors of all permit - required confined spaces.

C. Employees who enter confined spaces shall:

1. Comply with the confined space entry procedures (Appendix A) contained herein and with those procedures stipulated by their supervisor.

2. Maintain equipment used for confined space entry.

3. Report any deficiencies or malfunction of equipment to a supervisor.

4. Understand emergency procedures in case of an accident in a confined space.

5. Do not enter a confined space that is suspect of having hazardous atmosphere, even to rescue a fellow employee.
D. Protective Services shall be responsible for the following:

Protective Services will respond to calls for assistance in confined spaces and will be trained on the proper procedures for emergencies associated with confined space entry.

F. Contractors shall:

Comply with all applicable State and Federal Regulations

III. PERMIT REQUIRED CONFINED SPACE PROGRAM

A. Classifications of Confined Spaces

EH&S and Facilities will identify and classify every confined space as a:

1. Permit-Required Confined Space or a

2. Non-Permit Confined Space – a confined space does not present a real potential hazard.

B. Program Elements of a Permit required Confined Space

Supervisors will implement procedures and practices necessary for permit space entry operations. Theses include, but are not limited to:

1. Identifying All Confined Spaces

All confined spaces located within the facility or under the facility’s control should be identified. Once the space has been identified as a confined space, Environmental Health and Safety shall determine if a permit is required.

2. Preventing Unauthorized Entry

- In order to prevent unauthorized entry into permit-required confined spaces, the following must be utilized:
  - Training all employees
  - Providing information to visitors
  - Posting warning signs
  - Erecting barriers
- Installing locks or covers at entry points

3. The Permit System

- When a confined space must be entered, a permit shall be completed and authorized by Directors, Supervisors or designated representative prior to entry of the confined space. This permit shall serve as certification that the space is safe for entry. The permit shall contain the date, the location of the space, and the signature of the person providing the certification.

- A permit shall not be issued until all conditions of the permit have been met. The permit to be used by Washington University School of Medicine personnel can be found in appendix B.

4. Planning The Entry

- **Gathering General Data:**
  - Identify the confined space. Give the name or location of the confined space.
  - Give the reason for entering a confined space.
  - Identify if hot work will be done.

- **Identifying the Hazards:**
  - The Supervisor with assistance from EH&S will identify and evaluate the hazards of permit spaces before employees enter them.
  - Once a space has been identified as confined, the hazards that may be present within the confined space must be identified. Confined-space hazards can be grouped into the following categories: 1) Oxygen – Deficient Atmospheres, 2) Flammable atmospheres, 3) Toxic Atmospheres, and 4) mechanical and physical hazards.
  - Atmospheric testing shall be conducted before and during an entry to assure that acceptable conditions are maintained throughout the entry in accordance with Appendix A of the WUSM Entry Procedures.
  - The entry supervisor will determine the oxygen content and describe the testing procedures and the type of equipment used.
  - The entry supervisor will determine flammable gas content and describe the testing procedures and the type of analyzer used.
- If a toxic substance is determined to be in the confined space during testing by the entry supervisor, Environmental Health and Safety shall be contacted to assist in obtaining a material safety data sheet or other information to determine what type of personal protective equipment is required, the potential health effects, the permissible exposure limits, and any other information needed to safely conduct the work.

- Supervisors or their designated representatives will determine mechanical and physical hazards. They should list all items and energy that will require lockout/tagout, blanking and bleeding, disconnecting, or securing. Physical hazards should also be listed.

➢ Ventilation of the Confined Space

- Indicate whether mechanical or natural ventilation will be used. Describe the procedure to be used. It should be noted that if mechanical ventilation must be used, the exhaust must be pointed away from personnel or ignition sources. Also, mechanical ventilators should be bonded to the confined space.

➢ Isolating the permit space

- Describe the procedures for disconnecting equipment or lockout and tagout. All mechanical, electrical, or heat-producing equipment should be disconnected or locked/tagged out.

➢ Purging or Cleaning the Confined Space:

- Indicate if the confined space will be purged. Purging with inert gas is not recommended. If the space must be purged, describe the procedures.

- Indicate the type of cleaning methods to be used. If chemical cleaners are to be used, consult material safety data sheet prior to use.

➢ Placement of Warning Signs:

- Indicate if warning signs or barriers will be needed to prevent unauthorized entry or to protect workers from external hazards. If the confined space will be left open and unattended for any length of time, warning signs and barriers will be required.

➢ Identifying All Personnel
- List all employees that will be required to prepare the confined space and complete the work inside the space.

- Identify Necessary Equipment

- List all equipment that will be necessary to complete the project.

5. Confined Space Training

- Environmental Health and Safety shall provide training so that all employees whose work is regulated by this section acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned.

- Training shall be provided to each affected employee:
  - Before the employee is first assigned duties.
  - Before there is a change in assigned duties.
  - Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained.
  - Whenever the department has reason to believe either that there are deviations from the permit space entry procedures required by 29 CFR 1910.146 or that there are inadequacies in the employee's knowledge or use of these procedures.

- The training shall establish employee proficiency in the duties required by 29 CFR 1910.146 and shall establish new or revised procedures, as necessary, for compliance with this.

- The department shall certify that the training required by the previously mentioned paragraphs has been accomplished.

- The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training.

- The certification shall be available for inspection by employees and their authorized representatives.

- Only trained attendants, authorized entrants and personnel authorizing or in charge of entry shall work in and around a Permit Space.
IV. Responsibilities and Training Requirements of Authorized Entrants

The person(s) authorized to enter a confined space shall be responsible for and receive training in the following:

- The knowledge of hazards that may be faced during entry, including the mode, signs or symptoms, and consequences of the exposure.

- Proper use of equipment which includes:
  1. Atmospheric testing and monitoring equipment.
  2. Ventilation equipment needed to obtain acceptable entry conditions.
  3. Communication equipment necessary to maintain contact with the standby person.
  4. Personal Protective Equipment as needed.
  5. Lighting Equipment as needed.
  6. Barriers and Shields as needed.
  7. Rescue and emergency equipment

- Communication 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 if required.

- Alert the attendant (standby person) whenever:
  1. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or
  2. The entrant detects a prohibited condition

- Exiting the permit space as quickly as possible whenever:
  1. An order to evacuate has been given by the attendant or the entry Supervisor.
  2. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
3. The entrant detects a prohibited condition.

V. Responsibilities and Training Requirements of Standby Persons (Attendants)

Persons authorized to perform duties as attendant shall be responsible for and receive training in the following:

- Knowing the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure.

- Aware of possible behavioral effects of hazard exposure in authorized entrants.

- Continuously maintaining an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants accurately identifies who is in the permit space.

- Remains outside the permit space during entry operations until relieved by another attendant.

- Attempting non-rescue if proper equipment is in place and the rescue attempt will not present further hazards to the entrant or attendant.

- Communicating with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space when conditions warrant.

- Monitoring activities inside and outside the space to determine if it is safe for entrants to remain in the space and ordering the authorized entrants to evacuate the permit space immediately under any of the following conditions:
  1. If the attendant detects a prohibited condition
  2. If the attendant detects the behavioral effects of hazard exposure in an authorized entrant.
  3. If the attendant detects a situation outside the space that could endanger the authorized entrants.
  4. If the attendant cannot effectively and safely perform all the duties required by this program.

- Summoning rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards.
Taking the following actions when unauthorized persons approach or enter a permit space while entry is underway:

1. Warn the unauthorized person that they must stay away from the permit space.
2. Advise the unauthorized person that they must exit immediately if they have entered the permit space.
3. Inform the authorized entrants and the entry Supervisor if unauthorized persons have entered the permit space.

Performs no duties that might interfere with the attendant’s primary duty to monitor and protect the authorized entrants.

VI. Rescue and emergency Procedures

In the event of an emergency, the standby person should:

1. Immediately call the following hilltop or medical school emergency phone numbers:

   - **Hilltop Campus:**
     University police: 314-935-5555

   - **Medical School Campus:**
     Protective Services: 314-362-4357 or 362-HELP.

2. Hilltop University Police will notify the Clayton Fire Department to perform rescues.
   Medical School Protective Services will notify The St. Louis Fire Department to perform rescues.

3. If the standby person is able to remove the victim with the retrieval line, the attendant should administer aid within their limit of training until emergency medical services arrive.

4. If the standby person is unable to remove the victim by using the retrieval line, he or she must wait for help to arrive. The standby person(s) is not to enter the confined space for any reason.
5. Give rescue and emergency services any information requested.

6. At least annually, Washington University and the Fire Department will conduct a practice rescue drill.

Note: Washington University will provide the Fire Department with access to all permit spaces from which rescue may be necessary so that they can develop appropriate rescue plans and practice rescue operations.

Note: To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.

VII. Coordinating entry operations

All outside contractors performing work in confined space entry permit area shall be informed of any fire, explosion, health or other safety hazards of that confined space. This information shall be based on current or past history of the confined space and the nature of the contractor's work procedure in making such disclosure.

Each Department shall inform contractors of Washington University safety rules and emergency plans which may be applicable to the contractor's employees. Contractors and their employees must not be allowed to enter a confined space until the provisions of this program have been satisfied. When both Washington University and contractor personnel are working in or near permit spaces, their entry operations must be coordinated to avoid endangering any personnel.

At the conclusion of the entry operations, the contractor must be debriefed regarding the permit space program that was followed and concerning any hazards confronted or created in permit spaces during entry operations.

It is the responsibility of each contractor who is retained to perform permit space entry operations to obtain any available information regarding permit space hazards and entry operations from Washington University.

Contractors must also coordinate entry operations with Washington University when both Washington University and contractor personnel will be working in or near permit spaces. Washington University must be informed of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operations.

VIII. Concluding entry
The lead worker will determine when the entry operations have been completed. The permit space will be closed and the permit canceled. The lead worker will write "Permit Canceled" with the date, time and signature at the bottom of the Washington University Confined Space Permit. Entry into the permit space will only be allowed after following all aspects of this program.

IX. Alternate Entry

Employees who enter a confined space need not comply with the procedures set forth in the program provided that:

- It can be demonstrated that the only hazard posed by the permit space is an actual or potential hazardous atmosphere.
- It can be demonstrated that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry.
- Monitoring and inspection data are developed that support the previous conclusions.
- If an initial entry of the permit space is necessary to obtain the data required, the entry is performed according to the procedures set forth in this document concerning the entry of a permit required confined space.
- The determinations and supporting data required are documented and made available to each employee who enters the space.

X. Reclassification to a non-permit space

- If a permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

- If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed according to Appendix A, Confined Space Entry Procedures. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

Note: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards.
XI. DEFINITIONS

- **Acceptable entry conditions**: conditions that exist in a permit-required space to allow safe entry and work within the space.

- **Attendant (spotter)**: a person stationed outside one or more permit spaces who monitors the authorized employees and performs attendant's duties assigned in this policy.

- **Authorized Entrant/Employee**: person who has received confined space entry training from EH&S as an entrant/supervisor.

- **Blanking or Blinding**: closure of a pipe, line, or duct by fastening a solid plate (such as a spectacle blind or a skillet blind) completely covering the bore and that is capable of withstanding the maximum pressure of the pipe, line or duct with no leakage beyond the plate. This involves installing a blank between flanges with a leak-proof gasket at a point in the conducting line as close to the confined space area as possible. The blank or blind should be marked identifying its purpose.

- **Combustible Gas**: airborne concentration of gas or vapor which may present the risk of fire or explosion if an ignition source of sufficient energy is introduced. This term is synonymous with "flammable vapor" and "explosive gas".

- **Confined Space**: a space that meets all of the following criteria:
  - Is large enough and so configured that an employee can bodily enter and perform assigned work;
  - Has limited or restricted means for entry and exit (for example, tanks, tunnels, vessels, silos, storage bins, hoppers, vaults, and pits); and
  - Is not designed for continuous employee occupancy.

- **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.

- **Engulfment**: the surrounding or capture of a person by a liquid or finely divided (flowable) solid substance that can cause asphyxiation, drowning, or can exert enough force on the body to cause death by strangulation, constriction or crushing.

- **Entry Permit**: written authorization for entry into a "permit-required confined space."
• **Entry Supervisor:** first-line foreman or designated lead person, responsible for: determining if acceptable entry conditions have been verified and documented at a permit-required confined space where entry is planned; authorizing entry; overseeing entry operations; and terminating entry.

• **General Permit:** type of entry permit used to enter a confined space when all atmospheric and safety hazards have been controlled or eliminated. The general permit is used to verify and document that all hazards have been controlled or eliminated. If an entry is needed to evaluate, control or eliminate the hazardous conditions in the space, then a hazardous permit will be needed for this portion of the entry.

• **Hazardous Atmosphere:** 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:
  - Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit.
  - Airborne combustible dust that is at or approaching its lower flammable limit. This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.
  - Atmospheric oxygen concentration below 19.5% or above 23.5%.
  - Any chemical or substance present which may be at concentrations capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects and is above the regulatory limit.

• **Hazardous Permit:** the permit used to enter a confined space when either a hazardous atmosphere and/or a safety hazard has not been completely controlled or eliminated.

• **Hot Work Operations:** cutting, welding, brazing, torch soldering, high speed metal grinding, or use of an open flame.

• **Hot Work Permit:** the permit used to enter a confined space when hot work operations will be performed in the space.

• **Hot Work Safety Permit:** specific written authorization to perform hot work operations in any University space, including confined spaces. This is different from a Confined Space Hot Work Permit, in that it addresses potential fire safety hazards as specified in the Plant Operations Hot Work Safety Program.

• **Line Breaking or Misalignment:** the intentional and physical disconnection of a pipe, line or duct. Added protection is obtained by misarranging or removing a
section of the pipe, line, or duct. When potentially hazardous residues might remain downstream from the disconnecting point, the line should be purged and atmospheric testing conducted.

- **Lockout/Tagout**: A procedure whereby a lock and/or tag device is used to hold an energy-isolating device (such as a switch, valve, etc) in the "off" or safe position.

- **Lower Explosive Limit (LEL)**: lowest concentration at which a gas or vapor can ignite. Concentrations below this level are too lean to burn.

- **Non-Permit Required Confined Space**: confined spaces that do not contain or, have the potential to contain, any hazard capable of causing death or serious physical harm.

- **Permit-Required Confined Space**: a confined space that has one or more of the following characteristics:
  
  - Contains or has the potential to contain a hazardous atmosphere. When assessing the potential for a hazardous atmosphere, consideration must be given to portals of entry from other areas, such as pipes, ducts and vents.
  
  - Contains a material that has the potential for engulfing an entrant.
  
  - Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardsly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
  
  - Contains any other recognized serious safety or health hazard that may have an immediate effect or inhibit the employee leaving the space unaided. Examples include: exposed electrical parts and extreme temperature.
  
  - Upper Explosive Limit: the highest concentration at which a gas or vapor can ignite. Concentrations above this level are too rich to burn.
  
  - Work Induced Hazard: hazard created due to nature of work such as welding (generates fumes) and painting (generates solvents in the atmosphere).
Appendix A

Confined Space Entry Procedures

Equipment Required:

The following equipment is required to be with each crew performing confined space entries:

- Gas monitor
- Power ventilator
- Appropriate respirators as needed, which may include airline respirator system or self contained breathing apparatus (SCBA).
- Safety Tripod w/ safety harness
- Personal-lift (hoist) - required for vertical enters of more than 5 feet.
- Personal Protective Equipment including but not limited to: Hard Hat, Coveralls or other Protective Clothing, Gloves, Half Face Respirators with Chemical and Particulate Cartridges.
- Mobile Radio or communication system

Personnel:

A minimum two person crew is required. If the space and entry are difficult more employees may be needed because of the complexity of work and potential problems encountered when performing maintenance and repair. This includes extended entry times in manholes and vaults, chemical product usage, extensive equipment to use and handle, and often difficult traffic routing and control issues.

Procedures

General: Only Facilities Management Staff that have received Confined Space Entry Training may enter a confined space or serve as an attendant, entry supervisor or conduct air monitoring. The training will review all information contained within the confined space program.

All affected employees must follow the steps listed below in order to comply with this guideline.
Step 1
Permit

The "Entry Supervisor" fills out the Entry Permit (Appendix B) noting the specific requirements to be followed. The requirements will include the following steps.

Step 2
Testing (see Appendix F - Atmospheric Testing and Monitoring)

The entry supervisor will test the atmosphere as discussed in training:

1. Oxygen Content:
   - If oxygen content is less than 19.5 % or greater than 21.5, perform additional ventilation. Then, shut off ventilation equipment and re-test the oxygen content.
   - If oxygen content is between 19.5% and 21.5 %, continue the entry.

2. Flammable gas level:
   - If the meter is less than 10% of the lower explosive limit, continue entry preparations.
   - If the meter reading is above 10% of the LEL, continue ventilation of the confined space. Shut-off the ventilation and have the atmosphere re-tested.
   - If the meter reading is above 10% of the LEL, the confined space must be cleaned or purged before entry is permitted.

3. Toxicity of atmosphere:
   - The entry Supervisor will determine the toxicity of the atmosphere as planned and discussed in training. If a toxic atmosphere is present, no person should be permitted to enter the confined space at a level exceeding the Permissible Exposure Limit without proper personal protective equipment. Environmental Health and Safety should be notified to assist in identifying proper precautions and protective measures to be taken.

4. Testing Procedures
All testing equipment shall be calibrated by supervisor or authorized employee as instructed by the manufacturer.

All of the manufacturer’s operating instructions must be followed.

The test equipment should be tested in a known atmosphere to insure its accuracy.

Ventilation equipment must be shut off before conducting any atmospheric tests.

The atmosphere must be tested at the bottom, top, and middle of all confined spaces.

The atmosphere must be continuously monitored while work is being conducted in the confined space.

If the confined space is left for any reason, the atmosphere must be re-tested before re-entering the space.

5. Monitoring the Confined Space:

Record the levels on the permit and continually monitor while the space is open. If the monitoring indicates an unacceptable atmosphere after either ventilating or waiting for a short time period the entry supervisor needs to be notified. An acceptable atmosphere is defined on the permit. If the atmosphere is not acceptable then employees are NOT PERMITTED TO ENTER THE SPACE AND THE PERMIT WOULD NOT BE VALID.

Step 3
Ventilating

Ventilate with power ventilator of at least 750 CFM capacity or more. Ventilate until the atmosphere is safe to enter and continue to ventilate while the manhole is open.

Step 4
Rescue Device and Access

For manholes and vaults with vertical entrance of more than 5 feet a personal lift needs to be set up. Examine and inspect all the lines to ensure that they are functioning properly. For horizontal entrances have the employee in safety harness and life-line.
Step 5  
Communication

The employees discuss and determine communication methods prior to manhole or vault/tank entry. Emergency rescue procedures need to be determined and communicated with the entrant(s) and standby employees.

Step 6  
Respirator

If necessary, set up the breathing air supply system and inspect air supply system components to ensure proper function. Place the system in an area readily available to the work space.

Air line supply system is defined as: full face mask, 5-minute hip pack for emergency escape, and the remote air supply cylinder and hose line or a self contained breathing apparatus (SCBA).

*NOTE: In most cases entries are only permitted if the space atmosphere is acceptable. There are conditions, however, where the work will involve the use of paints, other chemicals, and welding that would require proper respiratory protection. This must be determined and stated on the permit based on the hazard.

Step 7  
Personal Protective Equipment

The employee entering puts on required personal protective equipment and is secured to the personal-lift. Wear respiratory protection if needed. The employee will generally wear the gas monitor, if not, the standby employee will monitor the atmosphere with a remote probe in the area where the entrant is working.

Step 8  
Standby Duties

When the standby employee topside is prepared, check gas monitor, and personal-lift. After all the equipment is checked then the employee can enter into the space. The topside employee will continuously check the gas monitor if the employee is not wearing the monitor or other personal air monitors.

Step 9  
Standby Duties

While the employee is in the manhole, the standby employee remains alert to his/her activity. Mobile radio source must be within 50 feet of the manhole work.
If gas monitor alarm activates, employee will signal the entrant and the entrant is to leave the space.

**Step 10**
**Exiting**

When the work is completed the entrant employee will signal topside observer(s) who will operate man-lift and life lines to ensure none become entangled with obstructions.

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**Appendix B**

*(Entry Permit Form)*

This confined space has been designated a Permit Required Confined Space. This space may only be entered by personnel who have been trained to work in a permit required confined space in accordance with Washington University Confined Space Entry Program. Entry operations may proceed only under the direction of the entry supervisor. A specially trained attendant shall remain outside the permit required confined space for the duration of the entry operation.

*Hazardous Conditions Identified During Evaluation*

**Atmospheric Hazards**

Describe: __________________________________________

Acceptable Entry Conditions: __________________________

Prohibited Conditions: ________________________________

**Physical Hazards**

Describe: __________________________________________

Acceptable Entry Conditions: __________________________

Prohibited Conditions: ________________________________

**Additional Personal Protective/Safety Equipment Needed**

<table>
<thead>
<tr>
<th>SCBA</th>
<th>Explanation: __________________________</th>
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<td>Safety Eqpt</td>
<td>Explanation: __________________________</td>
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<tr>
<td>Other</td>
<td>Explanation: __________________________</td>
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 Permit Authorization

<table>
<thead>
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<th>Permit #</th>
<th>Name:</th>
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<tbody>
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<td></td>
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<td></td>
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 Permit Cancellation

 Date:______ Time:___________ Cancelled by:__________________

 Reason For Cancellation:
# Appendix C

## Confined Space Pre-Entry Checklist

<table>
<thead>
<tr>
<th>Permit Number:___________</th>
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<td>Purpose of Entry:</td>
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<table>
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<th>Finish Time:</th>
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</thead>
<tbody>
<tr>
<td>(a.m./p.m.)</td>
<td>(a.m./p.m.)</td>
</tr>
</tbody>
</table>

**Employee(s) in charge of entry:**

- Entrants
- Attendants

### Pre-Entry Authorization:

(Click those items below which are applicable to your confined space permit)

- [ ] Oxygen – Deficient Atmosphere
- [ ] Oxygen – Enriched Atmosphere
- [ ] Welding/Cutting
- [ ] Engulfment
- [ ] Toxic Atmosphere
- [ ] Flammable Atmosphere
- [ ] Energized Electrical Equipment
- [ ] Entrapment
- [ ] Hazardous Chemical

### Safety Precautions

- [ ] Self-Contained Breathing Apparatus
- [ ] Air-Line Respirator
- [ ] Fire-Retardant Clothing
- [ ] Ventilation
- [ ] Protective Gloves
- [ ] Lifelines
- [ ] Respirators
- [ ] Lockout/Tagout
- [ ] Fire/Extinguishers
- [ ] Barricade Job Area
- [ ] Signs Posted
- [ ] Clearances Secured
- [ ] Lighting
- [ ] Ground Fault Interrupter

**Remarks:**

### Environmental Conditions

#### Test to be performed:

- Oxygen:_______%
- Lower Explosive Limit:_______%
- Toxic Atmosphere:_________
- Instruments Used:_____________________

<table>
<thead>
<tr>
<th>Date/Time (a.m./p.m.)</th>
<th>Date/Time (a.m./p.m.)</th>
</tr>
</thead>
</table>

#### Re-Testing:

- Oxygen:_______%
- Lower Explosive Limit:_______%
- Toxic Atmosphere:_________
- Instruments Used:_____________________

### Entry – Authorization

All actions or conditions for safe entry have been performed.

Person in charge of entry (Print Name):_______________________

### Entry Cancellation

Entry has been completed and all entrants have exited permit.

Person in charge of entry (Print Name):_______________________

---

Environmental Health & Safety, Washington University in St. Louis, Campus Box 1010, One Brookings Drive, St. Louis, Missouri 63130-4899, (314) 362-6816, Fax: (314) 935-9266, http://ehs.wustl.edu

21
Name: __________________________

Hilltop Emergency Phone #: 935-5555
Medical School Emergency Phone #: 362-4357 or 362-HELP
Confined Space Entry Notification

In compliance with 29 CFR part 1910.146, when the contractor’s work may involve entry into permit required confined spaces, Washington University must notify the contractor and inform them of the hazards associated with these spaces.

In the scope of this project, the workplace contains confined spaces and entry is allowed only through compliance with a confined space entry program. Prior to entry, the contractor must submit a copy of their confined space entry program to Washington University - Environmental Health and Safety.

Specific Location of the permit required confined space(s) (building, street, direction, type of space):___________________________________________________________

<table>
<thead>
<tr>
<th>Atmospheric Hazards (Potential or Existing)</th>
<th>Health &amp; Safety Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>___ Oxygen Content less than 19.5% or greater than 23%</td>
<td>___ Mechanical</td>
</tr>
<tr>
<td>___ LEL greater than 10%</td>
<td>___ Electrical</td>
</tr>
<tr>
<td>___ Hydrogen Sulfide</td>
<td>___ Engulfment</td>
</tr>
<tr>
<td>___ Carbon Monoxide</td>
<td>___ Entrapment</td>
</tr>
<tr>
<td>___ Other toxic gases or vapors</td>
<td>___ Slip, Trip, Fall</td>
</tr>
<tr>
<td>___ Work induced hazards (welding, hot work, painting, use of chemicals etc.)</td>
<td>___ Fire/Burn</td>
</tr>
<tr>
<td></td>
<td>___ Heat stress or Cold</td>
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<td></td>
<td>Other (Specify)</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Will Washington University personnel be working in the confined space? Yes___  No___

If yes, a meeting to coordinate entry activities is required.

At the conclusion of the entry operations the contractor is required to discuss with Washington University representative the procedures followed and any hazards found or created during entry operations. Copies of permits used will be given to the Washington University representative and forwarded to Environmental Health and Safety, Campus Box 8229.

WUSM representative (Print and sign)  Contractor Representative

Company Name and Address:

Job or P.O. #_________  Date:_______
Appendix E

CONFINED SPACE EVALUATION--ENTRY PERMIT SYSTEM
CONFINED SPACE ENTRY DECISION FLOW CHART

Will a confined space entry operation be conducted today?

- NO

  Does space have known or potential hazards?

    - NO

      STOP.

    - YES

      Space is a NPCS. Entry may begin according to NPCS entry procedures.

  - YES

    Can hazards or potential hazards be eliminated?

      - NO

        Space is a PRCS. Entry operations may begin following PRCS entry procedures.

      - YES

        Unforseen hazard is discovered.

        - YES

          Permit not valid. Entry is not permitted until acceptable conditions are met.

          - NO

            Entry operation is done. Complete post-entry evaluation forms for review.

        - NO

          Permit issued by signature of entry supervisor.

          - YES

            Acceptable entry condition maintained throughout entry operation?

              - NO

                Emergency exists

                Abort entry operation. Evacuate PRCS. Summon emergency response if needed. Re-evaluate entry operations, hazards and program. Entry not allowed until deficiencies are corrected.

              - YES


        - NO

          Acceptable entry conditions met? Verified?

            - NO

              Review permits and evaluation. Audit confined space entry program.

            - YES

              Entry operation is done. Complete post-entry evaluation forms for review.
Appendix F

ATMOSPHERIC TESTING AND MONITORING

Procedure For Atmospheric Testing And Monitoring:

Atmospheric testing is necessary for two purposes: evaluation of the hazards of the permit space and verification that acceptable entry conditions exist.

1. **Evaluation Testing:**

   The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate entry procedures can be developed and acceptable entry conditions stipulated for that space.

   A minimum of three tests should be performed to identify atmospheric hazards in confined spaces. These tests must be performed in the following sequence:

   - Oxygen Content
   - Flammability
   - Toxicity

2. **Verification Testing**

   The atmosphere of a permit space which may contain a hazardous atmosphere should be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions.

3. **Duration of Testing**

   Measurement of values for each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.

4. **Testing Stratified Atmospheres**

   When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of approximately 4 feet in the direction of travel and to each side. If a sampling
probe is used, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

5. **Equipment Calibration**

   To ensure that the atmospheric testing equipment is functioning properly, any direct reading test device should not be used without performing the following three operations:

   - Inspection
   - Calibration
   - Function Test

   All three operations should be performed according to specific manufacturer’s instructions.

6. **Air Monitoring Guide:**

   - Calibrate Instrument
   - Inspect Instrument:

     Check physical condition of instrument (case, meter, attachments, hoses for cracks) Review instructions to insure you know how to use the device and interpret results.

   - Perform Function Test

     - **Oxygen sensor:**

       Breath into sampling device to reduce the oxygen level below 19.5%. The oxygen alarm should sound.

     - **Combustible gas sensor:**

       1. Remove cap of solvent magic marker or open a cigarette lighter without a flame near the sampling device until it reaches a 10% reading.

       2. The combustible gas sensor should sound.

       3. Always perform a function test in the field before use.

       4. Never perform a function test in the suspected atmosphere.
• Pre-Test Space
  - Zero instrument in known fresh air.
  - Test entire space, top to bottom, every four feet and in the direction of travel.
  - Order of tests:
    1. Oxygen
    2. Flammability
    3. Toxicity

• Monitor the Space
  - If continuous monitoring is required, position the instrument near the workers breathing zone.
  - If any of the alarms sound, exit the space immediately.
  - Always record your readings.

Contact EH&S at 362-6816 if any atmospheric hazards cannot be reduced below the permissible exposure level with ventilation.