

## Confined Space Program

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**Responsible Office:** EH&S

### I. **Objective**

The purpose of William & Mary's (WM) Confined Space Program is to set procedures ensuring safe entry of workers into non-permit required confined spaces and permit-required confined spaces to perform tasks associated with their employment. This procedure is designed to provide safety requirements in accordance with the Occupational Safety and Health Administration's (OSHA) Confined Space Standard 1910.146.

### II. **Background**

OSHA defines a *confined space* as 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.

This describes many kinds of areas a worker can come in contact with on a daily basis and it also illustrates what would be considered a *non-permit required* confined space. A non-permit required confined space means a confined space that does not contain, or with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

A *Permit-required* confined space (permit space) means a confined space that has one or more of the following characteristics:

- Contains or has potential to contain hazardous atmosphere.
- 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 inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard

### III. **Assignment of Responsibility**

#### Employer

Responsible for the administration of the Confined Space Program, including but not limited to:

- Monitoring the effectiveness of the program.
- Ensure atmospheric testing and equipment is completed.
- Providing personal protective equipment.
- Providing training to affected employees and supervisors.
- Providing technical assistance as needed.
- Review and update the program annually or as needed.

The Environmental Health & Safety Office (EH&S) is responsible for administering the Confined Space Program and ensure compliance.

#### Program Manager

Environmental Health & Safety (EH&S) is responsible for managing the Confined Space Program, and shall:

- Develop and maintain a list of all confined spaces on campus.
- Review and conduct quality assurance checks on all permits.
- Provide training to all personnel and maintain training records.
- Liaise with local responders to ensure compliance and coordination.
- Ensure that equipment is in compliance with standards.
- Ensure that the entrants, attendants and entry supervisor:
  - Meet requirements for entry before entry is authorized.
  - Perform confined space monitoring with personnel qualified and trained in confined space entry procedures.

- Are informed of potential hazards that may be faced during entry, signs or symptoms of exposure to contaminants, and consequences of exposure.
- Complete the entry permit.
- Determine the entry requirements.
- Are aware of permit requirements.
- Post the permit in a conspicuous location near the job.
- Determine the number of Attendants required to perform the work.
- Brief personnel on communication plan.
- Post barriers and signs.
- Remain alert to changing conditions that might affect the conditions of the permits
- Change and reissue the permit or issue a new permit as necessary.
- Conduct periodic atmospheric monitoring according to permit requirements.
- Ensure that personnel doing the work and all support personnel adhere to permit requirements.
- Ensure the permit is canceled when the work is done.
- Ensure the confined space is safely closed and all workers are cleared from the area.

### Entry Supervisor

A trained Responsible Person(s) shall serve as the Entry Supervisor(s) and shall be qualified and authorized to approve confined space entry permits. The Entry Supervisor(s) shall be responsible to:

- Know space hazards including information on the mode of exposure, signs or symptoms and consequences.
- Determine if conditions are acceptable for entry.
- Verify by checking appropriate entries have been made on the permit, all tests specified by the permit have been conducted, and that all procedures and equipment specified by the permit are in place before endorsing permit and authorizing entry and overseeing entry operations.
- Terminate entry procedures as required.
- Serve as an Attendant, as long as the person is trained and equipped appropriately for that role.
- Ensure measures are in place to keep unauthorized personnel clear of the area.
- Check the work at least twice a shift to verify and document permit requirements are being observed (more frequent checks shall be made if operations or conditions are anticipated that could affect permit requirements).

- Ensure that necessary information on chemical hazards is kept at the worksite for the employees or rescue team.
- Ensure WMPD is notified of permit required confined space entry and is monitoring the WM911 frequency.

### Attendant

The trained Responsible Person(s) shall function as an Attendant(s) and shall be stationed outside of the permit-required confined workspace. The Attendant(s) shall:

- Be knowledgeable of, and be able to recognize potential confined space hazards, including information on mode of exposure, signs, symptoms, consequences and physiological effects.
- Maintain a sign-in/sign-out log with a count of all persons in the confined space, and ensure all entrants sign in and out.
- Remain outside the permit space during entry operations unless relieved by another authorized attendant
- Perform atmospheric monitoring to evaluate for hazardous conditions prior to entry
- Monitor surrounding activities to ensure the safety of personnel.
- Maintain effective and continuous communication with personnel during confined space entry, work, and exit.
- Order personnel to evacuate the confined space if he/she:
  - Observes a condition which is not allowed on the entry permit.
  - Notices the entrants acting strangely, possibly as a result of exposure to hazardous substances.
  - Notices a situation outside the confined space which could endanger personnel.
  - Notices a hazard within the confined space that has not been previously recognized or taken into consideration.
  - Must leave his/her workstation; or
  - Must focus attention on the rescue of personnel in some other confined space that he/she is monitoring.
- Immediately summon the Rescue Team if crew rescue becomes necessary.
- Keep unauthorized persons out of the confined space, order them out, or notify authorized personnel of an unauthorized entry.

- Perform no other duties that interfere with the Attendant's primary duties.

#### Entrant

Employees who are trained and authorized to enter a permit-required confined spaces shall:

- Read and observe the entry permit requirements.
- Remain alert to the hazards that could be encountered while in the confined space, including information on mode, signs, symptoms and consequences of the exposure.
- Properly use the personal protective equipment that is required by the permit.
- Immediately exit the confined space when:
  - Ordered to do so by an authorized person,
  - They notice or recognize signs or symptoms of exposure to air contaminants, or
  - A prohibited condition exists, or
  - An automatic alarm system sounds.
- Alert Attendant(s) when a prohibited condition exists and/or when warning signs or symptoms of exposure exist.

#### Rescue Team

Rescues are performed by Emergency Response personnel only. They are summoned by contacting WMPD via the radio or dialing 757-221-4596 from a cell phone. Williamsburg Fire Department is the initial responder but may require additional assistance from James City and York Counties.

## IV. **Training**

EH&S shall provide training for all employees whose work is regulated by this Confined Space Program to acquire the understanding, knowledge, and skills necessary for the safe performance of their duties in confined spaces. The training shall establish employee proficiency in the duties required in this program, and shall introduce new or revised procedures, as necessary, for compliance with this program.

#### Training Frequency

Responsible Person shall provide training to each affected employee:

- Before the employee is first assigned duties within a confined space and then every two years
- When there is a change in assigned duties
- When there is a change in permit space operations that presents a hazard for which an employee has not been trained
- When EH&S has reason to believe that there are deviations from the confined space entry procedures required in this program, or that there are inadequacies in the employee's knowledge or use of these procedures

#### General Training

All personnel responsible for supervising, planning, entering, or participating in confined space entry and non-entry rescue shall be adequately trained in their functional duties prior to any confined space entry. Refresher training shall be conducted bi-annually and as needed to maintain employee competence in entry procedures and precautions, as stated above.

Training shall include:

- Explanation of the general hazards associated with confined spaces
- Specific confined space hazards associated with the facility, location, or operation
- Proper use, and limitations of personal protective equipment and other safety equipment required for entry into confined spaces
- Explanation of permits and other procedural requirements for conducting a confined space entry
- A clear understanding of what conditions would prohibit entry.
- Procedures for responding to emergencies
- Duties and responsibilities of the confined space entry team
- Description of how to recognize symptoms of overexposure to probable air contaminants in themselves and co-workers, and method(s) for alerting the Attendant(s)
- First Aid/CPR training

#### Specific Training

Training for atmospheric monitoring personnel shall include proper use of monitoring instruments, including instruction on the following:

- Proper use of the equipment
- Calibration of equipment
- Sampling strategies and techniques
- Exposure limits (PELs, TLVs, LELs, UELs, etc.).
- Procedures for summoning rescue or other emergency services
- Proper utilization of equipment used for communicating with entry and emergency personnel.
- Rescue plans and procedures developed for each type of confined space that is anticipated to be encountered
- Use of emergency non-entry rescue equipment

#### Verification of Training

Periodic assessment of the effectiveness of employee training shall be conducted by EH&S. Training sessions shall be repeated as often as necessary to maintain an acceptable level of personnel competence.

## V. Identification of Hazards and Evaluation of Confined Spaces

Facilities Maintenance personnel in cooperation with EH&S, should ensure a survey of the worksite is conducted to identify *permit* and *non-permit* required confined spaces. This survey can be partially completed from initial and continuing site characterizations, as well as other available data (i.e., blueprints and job safety analyses). The purpose of the survey is to develop an inventory of those locations and/or equipment that meets the definition of a confined space. This information shall be communicated to personnel, and appropriate confined space procedures shall be followed prior to entry. The initial surveys shall include air monitoring to determine the air quality in the confined spaces. The potential for the following situations shall be evaluated:

- Flammable or explosive potential
- Oxygen deficiency
- Presence of toxic and corrosive material

#### Hazard Reevaluation

The entry supervisor shall identify and re-evaluate hazards based on possible changes in activities or other physical or environmental conditions that could adversely affect work. A master inventory of confined spaces shall be maintained. Any change in designation of a confined space will be routed to all affected personnel by the entry supervisor.

#### Pre-Entry Hazard Assessment

A hazard assessment shall be completed prior to any entry into a confined space. The hazard assessment should identify:

- Sequence of work to be performed in the confined space.
- Specific hazards known or anticipated; and
- Control measures to be implemented to eliminate or reduce each of the hazards to an acceptable level.

*No entry shall be permitted into a confined space until a hazard assessment has been reviewed by all persons engaged in the activity.*

*Confined spaces with employees from more than one contractor are to have coordinated entry operations. This will ensure an employee from one contractor does not endanger the employees of another. The W&M Project Manager(s) or Contract Administrator(s) responsible for contractors entering a confined space are responsible to ensure entry operations are coordinated.*

#### Hazard Controls

Hazard controls shall be instituted to address changes in the work processes and/or working environment. Hazard controls must be able to either control the health hazards by eliminating the responsible agents, reduce health hazards below harmful levels, or prevent the contaminants from coming into contact with the workers.

The following order of precedence shall be followed in reducing confined space risks.

#### Engineering Controls

Engineering controls are those controls that eliminate or reduce the hazard through implementation of sound engineering practices. Ventilation is one of the most common engineering controls used in confined spaces. When ventilation is used to remove

atmospheric contaminants from a confined space, the space shall be ventilated until the atmosphere is within the acceptable ranges. Ventilation shall be maintained during the occupancy if there is a potential for the atmospheric conditions to move out of the acceptable range. When ventilation is not possible or feasible, alternate protective measures or methods to remove air contaminants and protect occupants shall be determined by the entry supervisor prior to authorizing entry. When conditions necessitate and can accommodate continuous forced air ventilation, the following precautions shall be followed:

- Employees shall not enter the space until the forced air ventilation has eliminated any hazardous atmosphere.
- Forced air ventilation shall be directed so as to ventilate the immediate areas where an employee is or will be present within the space.
- Continuous ventilation shall be maintained until all employees have left the space.
- Air supply for forced air ventilation shall originate from a clean source.

#### Work Practice (Administrative) Controls and Personal Protective Equipment

Work practice (administrative) controls are those controls which eliminate or reduce the hazard through changes in the work practices (i.e., rotating workers, reducing the amount of worker exposure, and housekeeping) and proper personal protective equipment (PPE).

If the hazard cannot be eliminated or reduced to a safe level through engineering and/or work practice controls no entry is permitted. EH&S will determine the appropriate PPE needed by all personnel entering the confined space. PPE will be identified on the Confined Space Entry Permit. Typical PPE includes a hard hat, protective eye wear, protective clothing, hearing protection, fall protection, and respiratory protection.

## VI. **Entry Permits**

The Confined Space Entry Permit is an essential tool for assuring safety during entry in confined spaces with known hazards, or with unknown or potentially hazardous atmospheres. The entry permit process guides the supervisor and workers through a systematic evaluation of the space to be entered. The permit should be used to establish appropriate conditions. Before each entry into a permit required confined space, an entry permit will be completed by the entry supervisor with the assistance of EH&S. The entry supervisor will then communicate the contents of the permit to all employees involved in the operation and post the permit conspicuously near the work location. A standard entry

permit shall be used for all permit required confined space entries and is obtained from the EH&S office. A non-permit required confined space does not have a known potential hazard.

#### Key Elements of Entry Permits

A standard entry permit shall contain the following items:

- Space to be entered
- Purpose of entry
- Date and authorized duration of the entry permit
- Name of authorized entrants within the permit space
- Means of identifying authorized entrants inside the permit space (i.e., rosters or tracking systems)
- Name(s) of personnel serving as Attendant(s) for the permit duration
- Name of individual serving as Entry Supervisor, with a space for the signature or initials of the Entry Supervisor who originally authorized the entry
- Hazards of the permitted space to be entered
- Measures used to isolate the permit space and to eliminate or control permit space hazards before entry (i.e., lockout/tagout of equipment and procedures for purging, ventilating, and flushing permit spaces)
- Acceptable entry atmospheric conditions
- Results of initial and periodic atmospheric tests performed, accompanied by the names or initials of the testers and the time(s) when the tests were performed
- Means of contacting rescue and emergency services (i.e., equipment to use, phone numbers to call)
- Communication procedures used by entrants and attendant(s) to maintain contact during the entry
- Equipment to be provided (i.e., PPE, testing, communications, alarm systems, and rescue)
- Any additional information regarding the confined space that will help ensure employee safety
- Additional permits, such as for hot work, that have been issued to authorize work on the permit space

#### Permit Scope and Duration

A permit is only valid for one shift. For a permit to be renewed, the below shall be met before reentry into the confined space.

A new permit shall be issued, or the original permit will be reissued, if possible, whenever changing work conditions or work activities introduce new hazards into the confined space. EH&S shall retain each canceled entry permit for at least one (1) year to facilitate the review of the Confined Space Entry Program. Any problems encountered during an entry operation shall be noted on the respective permit(s) so that appropriate revisions to the confined space permit program can be made.

## VII. **Entry Procedures**

When entry into a confined space is necessary, the Entry Supervisor and EH&S will initiate the entry procedures, including the completion of a confined space entry permit. Entry into a confined space shall follow the standard entry procedure below.

### Prior to Entry

The entire confined space entry permit shall be completed before a standard entry. Entry shall be allowed only when all requirements of the permit are met and it is reviewed and signed by an Entry Supervisor. The following conditions must be met prior to standard entry:

- Affected personnel shall be trained to establish proficiency in the duties that will be performed within the confined space.
- The internal atmosphere within the confined space shall be tested with a calibrated, direct-reading instrument.
- Personnel shall be provided with necessary PPE as determined by the Entry Supervisor.
- Continuous atmospheric monitoring shall take place during the entry. If a hazardous atmosphere is detected during entry, personnel within the confined space shall be evacuated until the space can be evaluated to determine how the hazardous atmosphere developed and controls shall be put in place to protect employees before reentry is allowed.

### Opening a Confined Space

Any conditions making it unsafe to remove an entrance cover shall be eliminated before the cover is removed. When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent anyone

from falling through the opening. This barrier or cover shall protect each employee working in the space from foreign objects entering the space. If it is in a traffic area, adequate barriers shall be erected.

#### Atmospheric Testing

Atmospheric test data is required prior to entry into a confined space. Atmospheric testing is required to evaluate the hazards in the confined space and verify that acceptable conditions exist for entry into that space. Prior to entry into a permit required confined space, the entry supervisor/attendant shall conduct testing for hazardous atmospheres. The internal atmosphere shall be tested with a calibrated, direct-reading instrument for oxygen, flammable gases and vapors, and potential toxic air contaminants, in that order.

All testing equipment shall be approved by a nationally recognized laboratory, such as Underwriters Laboratories or Factory Mutual Systems.

*Evaluation Testing:* The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity. The analysis shall identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate permit entry procedures can be developed and acceptable entry conditions stipulated for that space. Evaluation and interpretation of these data and development of the entry procedure should involve a technically qualified professional (i.e., EH&S).

*Verification Testing:* A confined space that may contain a hazardous atmosphere shall be tested for residues of all identified or suspected contaminants. The evaluation testing should be conducted with specified equipment to determine that residual concentrations at the time of testing and entry are within acceptable limits. Results of testing shall be recorded by the person performing the tests on the permit. The atmosphere shall be periodically retested to verify that atmospheric conditions remain within acceptable entry parameters.

*Acceptable Limits* the atmosphere of the confined spaces shall be considered to be within acceptable limits when the following conditions are maintained:

- Oxygen: 19.5 percent to 23.5 percent
- Flammability: Less than 10 percent of the Lower Flammable Limit (LFL)
- Toxicity: Within acceptable limits as recognized American Conference of Governmental Industrial Hygienists (ACGIH) exposure limits or other published exposure levels [i.e., OSHA Permissible Exposure Limits (PELs) or National Institute

of Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs)]. Examples of toxins include hydrogen sulfide (H<sub>2</sub>S) and carbon monoxide (CO).

#### Isolation and Lockout/Tagout Safeguards

All energy sources that are potentially hazardous to confined space entrants shall be secured, relieved, disconnected, and/or restrained before personnel are permitted to enter the confined space. Equipment systems or processes shall be locked out and/or tagged out by trained personnel as required by the Lockout/Tagout program prior to permitting entry into the confined space. In confined spaces where complete isolation is not possible, the entry supervisor and EH&S shall evaluate the situation and make provisions for as rigorous an isolation as practical.

Where there is a need to test, position, or activate equipment by temporarily removing the lock or tag or both, a procedure shall be developed and implemented to control hazards to the occupants. Any removal of locks, tags, or other protective measures shall be done in accordance with the Lockout/Tagout Program.

#### Ingress/Egress Safeguards

Means for safe entry and exit shall be provided for confined spaces. Each entry and exit points shall be evaluated by the entry supervisor to determine the most effective methods and equipment that will enable employees to safely enter and exit the confined space.

Appropriate retrieval equipment or methods shall be used whenever a person enters a confined space. Use of retrieval equipment may be waived by the entry supervisor if use of the equipment increases the overall risks of entry or does not contribute to the rescue. A mechanical device shall be available to retrieve personnel from vertical confined spaces greater than five (5) feet in depth.

#### Warning Signs and Symbols

All permit confined spaces that could be inadvertently entered shall have signs identifying them as confined spaces. Signs shall be maintained in a legible condition. The signs shall contain a warning, such as DANGER - PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER, indicating a permit is required before entry. Accesses to all permit confined spaces shall be prominently marked. All manholes on campus are considered permit required confined spaces, regardless of marking.

## VIII. **Emergency Response**

### Emergency Response Plan

All entry required rescues will be conducted by the emergency services personnel. They are summoned via the WM911 radio channel or calling 911.

### Retrieval Systems and Methods of Non-Entry Rescue

Retrieval systems shall be available and ready when an authorized person enters a permit space, unless such equipment increases the overall risk of entry, or the equipment would not contribute to the rescue of the entrant. Retrieval systems shall have a chest or full-body harness and a retrieval line attached at the center of the back near shoulder level or above the head. The retrieval line shall be firmly fastened outside the space so that rescue can begin as soon as anyone is aware that retrieval is necessary. A mechanical device shall be available to retrieve personnel from vertical confined spaces more than five (5) feet deep.

### Attendant Rescue Responsibilities

Attendants may attempt a non-entry rescue using the retrieval system to remove an entrant from the confined space only if all the following conditions apply:

- The entrant is unable to self-rescue
- A life-threatening danger to the entrant is imminent
- The attendant remains outside the confined space at all times
- The entrant is attached to the retrieval system
- The attendant can visually or verbally confirm from outside the confined space that the retrieval system is disentangled from objects in the confined space and free of other obstructions.





**PART B**

**Atmospheric Testing for Confined Space Entry**

Instrument make/serial no.:	Calibration date:
Person Performing tests:	

**Test Results**

Tests Required	Safe Limits	Time	Time	Time	Time	Time	Time
		Results	Results	Results	Results	Results	Results
O <sub>2</sub>	19.5-23.5%						
Combustibles	<10% LEL						
Toxics							
H <sub>2</sub> S	<10 ppm						
CO	<25 ppm						
Others:							

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H <sub>2</sub> S	<10 ppm						
CO	<25 ppm						
Others:							

**Entry/Exit Times**

Entrant Name	Enter	Exit	Enter	Exit	Enter	Exit

Rescue services will be contacted using the WMPD911 channel on the WM Radios or 911. Prior to entry and again after entry is complete contact W&M PD at 221-4596. Dispatch will monitor the frequency for emergencies.