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Introduction

Scope:

In accordance with the Williams College Office of Environmental Health and Safety, the following confined space guidelines have been designed to provide the appropriate health and safety requirements that are to be followed when entering, exiting, and working in our confined spaces. The guidelines contained herein describe the reasonable and necessary policies and procedures for any and all facilities, departments, and individuals who are associated with confined space entry operations. This program and all parts of 29 CFR 1910.146 shall apply to all confined space entry operations conducted at Williams College.

Purpose:

To establish guidelines and performance objectives for the health and safety of Williams College employees and contractors that are to perform work in both permit and non-permit required confined spaces at Williams College.

Application:

The Williams College Confined Space Guidelines and other applicable requirements found herein shall at least comply with, if not exceed, local, state and federal requirements. It is the responsibility of all College personnel and contractors working in all confined spaces at Williams College to adhere to this confined space guideline; unless the use of a stricter guideline, policy or program is utilized.

Identifying Confined Spaces

Recognition is an important aspect of making a safe entry into a confined space. It is the responsibility of the Williams College Office of Environmental Health and Safety to identify all confined spaces and determine whether or not they are permit or non-permit required.

To clarify what constitutes a confined space, the following definition will be used.

A **Confined Space** is any space that has the following characteristics:

1. **It is large enough or so configured that an employee can bodily enter and perform assigned work.**
2. **It has limited or restricted means for entry or exit.**
Confined-space openings are limited primarily by size and location. Openings may be small in size and may be difficult to move through easily. However, in some cases openings may be very large; for example, open-topped spaces such as pits or excavations. Entrance and exit may be required from top, bottom, or side. In some cases, having to access the work area by a fixed ladder may constitute limited or restricted entry or exit. Size or location will generally make rescue efforts difficult.

3. **It is not designed for continuous employee occupancy.**

Most confined spaces are not designed for employees to enter and work on a routine basis. Because they are not designed for continuous occupancy, frequently they will not have good ventilation or lighting. Therefore, occasional employee entry for inspection, maintenance, repair, cleanup, or similar tasks, can be difficult and dangerous. The danger associated with entry may come from chemical or physical hazards within the space.

Non-Permit vs. Permit Required Confined Spaces

The areas deemed to be permit-required shall have signage or other equally effective means of identification at any and all entrances to the confined space. Areas that have been identified as “non-permit” required confined spaces, that must be entered for the purpose of cleaning, brazing, cutting, heating, soldering and welding or which contains water or other known or potential hazard shall be classified either temporarily or permanently as a “permit required” confined space.

A **Non-Permit Confined Space** is a confined space that does not contain, nor has the potential to contain, any hazard capable of causing death or serious physical harm. Examples of non-permit required confined spaces might include the interiors of HVAC units, certain air plenums and pipe chases, attics, walk-in freezers or refrigerators, and some building crawl spaces.

A **Permit-Required Confined Space** has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere.
2. Contains a material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly-converging walls or by a floor that slopes downward and tapers to a smaller cross-section; or
4. Contains any other recognized serious safety or health hazard. Examples of serious safety or health hazards might include: fall hazards, unguarded machinery, extreme heat or cold, steam pipes or chemical lines, electrical hazards, asbestos, or hazardous levels of dust.

Examples of permit-required confined spaces at Williams College include steam tunnels, sewers, electrical vaults, boilers, tanks and vessels, excavations greater than 5 ft. deep, and other types of enclosures. Without exception, any space that is accessed by lifting a manhole cover shall be considered a permit-required confined space.

IDENTIFYING CONFINED SPACE HAZARDS

Acceptable and Unacceptable Atmospheric Conditions

Once a confined space has been identified, the hazards that may be present within this area 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.

Every confined space must be evaluated for these four types of hazards. The types of atmospheric hazards are often the most difficult to identify since they are normally invisible. The most common toxic atmospheres are carbon monoxide, methane, and hydrogen sulfide (sewer gas). Carbon monoxide is colorless and odorless and will readily mix with the air thus making it impossible to detect without the use of equipment. Methane gas is lighter than air and will rise to its highest level. Hydrogen sulfide can be initially detected by the "rotten eggs" odor and it is heavier than air and will seek its' lowest point.

After evaluation by a *qualified person*, the atmospheric conditions of a confined space shall be considered acceptable provided:

Oxygen - is between 19.5% and 23.5%

Flammability - is less than 10% of the LEL or LFL

Carbon Monoxide - is less than 35 ppm

Hydrogen Sulfide - is less than 10 ppm Toxicity - is less than recognized exposure limits (i.e. PEL or TWA)

1. Oxygen-Deficient Atmospheres

The normal atmospheric conditions are comprised of approximately 21% oxygen and 79% nitrogen. An atmosphere containing less than 19.5% oxygen shall be considered oxygen-deficient. The oxygen level inside a confined space may be decreased as the result of either consumption or displacement.

There are a number of processes which consume oxygen in a confined space. Oxygen is consumed during combustion of flammable materials, as in welding, cutting, or brazing. Oxygen can also be consumed during chemical reactions such as in the formation of rust on the exposed surfaces of a confined space. The number of people working in a confined space and the amount of physical activity can also influence oxygen consumption. Oxygen levels can also be reduced as the result of oxygen displacement by other gases.

2. Flammable Atmospheres

Flammable atmospheres are generally the result of flammable gases, vapors, dust mixed in certain concentrations with air, or an oxygen-enriched atmosphere.

Oxygen-enriched atmospheres are those atmospheres which contain an oxygen concentration greater than 23.5%. An oxygen-enriched atmosphere will cause flammable materials such as clothing and hair to burn violently when ignited.

Combustible gases or vapors can accumulate within a confined space when there is inadequate ventilation. Gases that are heavier than air will accumulate in the

lower levels of a confined space. Therefore, it is especially important that atmospheric tests be conducted near the bottom of all confined spaces.

The work being conducted in a confined space can generate a flammable atmosphere. Work such as spray painting, coating, or the use of flammable solvents for cleaning can result in the formation of an explosive atmosphere. Welding or cutting with oxyacetylene equipment can also be the cause of an explosion in a confined space and shall not be allowed without a hot work permit. The atmosphere shall be tested continuously while **any hot work is being conducted** within the confined space.

3. Toxic atmospheres may be present within a confined space as the result of one or more of the following:

a. The product stored in the Confined Space

When a product is stored in a confined space, the product can be absorbed by the walls and give off toxic vapors when removed or when cleaning the residual material. The product can also produce toxic vapors which will remain in the atmosphere due to poor ventilation.

b. The Work Being Conducted in the Confined Space

Toxic atmospheres can be generated as the result of work being conducted inside the confined space. Examples of such work include: Welding or brazing with metals capable of producing toxic vapors, painting, scraping, sanding, etc. Many of the solvents used for cleaning and/or degreasing produce highly toxic vapors.

c. Areas Adjacent to the Confined Space

Toxic fumes produced by processes near the confined space may enter and accumulate in the confined space. For example, if the confined space is lower than the adjacent area and the toxic fume is heavier than air, the toxic fume may "settle" into the confined space.

4. Mechanical and Physical Hazards

Problems such as rotating or moving mechanical parts or energy sources can create hazards within a confined space. All rotating or moving equipment such as pumps, process lines, electrical sources, etc., within a confined space must be identified and locked/tagged out.

Physical factors such as heat, cold, noise, vibration, and fatigue can contribute to accidents. These factors must be evaluated for all confined spaces entry operations.

Excavations could present the possibility of engulfment. Employees shall be protected from cave-ins by sloping, benching, or shoring systems when the depth of the excavation is more than five feet, in accordance with 29 CFR 1926.652.

Confined Space Entry Procedures

Prior to entering a “permit required” confined space, an entry permit must be obtained from the Office of Environmental Health and Safety. After obtaining the permit, the individuals must determine if the area requires alarm de-activation. If so, an official of Williams College (i.e. EH&S, Fire Safety, Security) must be summoned to do so. Prior to deactivating the alarm the College Official will request to see the permit to ensure all procedures have been followed. Without exception, prior to entering into any permit required confined space the Williams College Security Department shall be notified of the entry. Upon exiting the space for an extended period of time (i.e. lunch, end of work) notification will also be made to the Security Department.

After notification, the single most important procedure before entering any confined space is to use a meter to test the atmospheric hazards present. All atmospheric testing equipment shall be furnished by the Williams College EH&S Department. Contractors wishing to utilize their own testing equipment must meet or exceed the testing covered by the EH&S equipment and will be required to provide a current calibration certificate. Additionally, all tripods, harnesses, and hood ventilation systems will be provided by the Office of EH&S.

Entry Specific Procedures:

All confined spaces at Williams College have some type of procedure that must be followed before entering.

Tunnel Entry

All tunnels are to be considered permit-required; they are locked and/or alarmed to prevent regular access and must be opened by an Official of Williams College. When entering/re-entering a tunnel the three reading rule shall always apply. Atmospheric readings must be recorded outside, immediately inside (i.e. break the plane), and at the final destination within the tunnel. If at any point prior to entry, a determination is made that the atmosphere is not suitable for entry, as prescribed herein, the individuals must contact the EH&S Office for assistance. All applicable requirements of the permit shall be met before entry is made. This may include, but is not limited to eliminating atmospheric hazards by purging or ventilating, isolating hazardous energy (lock-out/tag-out), requiring the use of PPE, providing communication equipment, etc... Entrants will be required to have a Scott Skat-Pac with them during any operations in the tunnels. Light sticks are also provided in the event of a power failure.

Manhole Entry

Sewers, storm drains, and electrical manholes are to be considered permit-required confined spaces. In addition to the initial training, initial site specific manhole entry training will be provided upon the first request for entry.

1. Confined Space Entry Permit in hand to enter, (**Sewer, Storm Drains, and Electrical**)
2. Air testing to be done at 1ft. intervals all the way to the bottom of the area. Testing before and during operations in these areas is essential.
3. Tripod to be set up before entering.
4. Full body harness to be worn during operations.
5. Ventilation equipment to be on the job.
6. If ventilation is required, EH&S staff to be present before entering.
7. Attendant to be on stand-by outside the hole at all times, equipped with a radio for communication. The attendant may not leave his post while a co-worker is in the confined space.

Boilers

1. Confined Space Entry Permit may be required before entering.
2. Attendant outside the boiler with a radio at all times.
3. Lock out all electrical power to boiler during this operation using the proper lockout/tagout procedures

Tanks & Vessels

1. Permit required for entry.
2. Air testing to be done before and during operations in these areas.
3. Ventilation equipment will be required and closely monitored.
4. Attendant required with a radio for communication, (supervisor should be present during these operations).
5. Supplemental oxygen breathing equipment or a PAPR will be required for any duties performed.
6. Proper lighting for safe operations.

Electrical Vault or Rooms

1. Permit required to enter underground vaults, no permit needed for electric rooms.
2. Attendant required outside electrical room with a radio at all times.
3. An electrical vault is permit required area, follow manhole procedures.

Personnel Responsibilities

The employer shall ensure that all personnel who are to be considered for confined space *entry*, monitoring and associated work are authorized, trained and periodically evaluated to perform the work. The responsibilities for each position are identified below.

The permit can be revoked at any time by the *attendant, entry supervisor or other qualified person* if a condition arises or exists that may cause illness, injury or death to the confined space entrants.

1. The person that revokes the permit shall make sure that all confined space entrants have been evacuated and accounted for
2. They shall then indicate on the permit the reasons for revocation
3. They shall then notify the EH&S Office or if warranted summon 911 via the Security Radio provided to the attendant.

Entry Supervisors:

1. Ensuring that the required atmospheric tests are performed at the confined space and results recorded on the permit prior to entry authorization.
2. Obtaining and maintaining all equipment necessary to complete the confined-space entry project.
3. Authorizing entry by signing the Entry Authorization space on the entry permit after all conditions for a safe entry have been met.
4. Terminating the entry and canceling the permit when:
 - a. Entry operations covered by the entry permit have been completed.
 - b. A condition that is not allowed under the entry permit arises in or near the permit space.
 - c. Determining, whenever responsibility for a permit space entry operation is transferred, and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

Authorized Entrants:

1. shall be familiar with the known or potential hazards before *entry* and while working in the confined space - hazards might include: asbestos, electrical, environmental conditions, fire, signs and symptoms of exposure, steam

2. shall not enter the confined space until the appropriate equipment is on site and placed into operation:
 - tripods and rescue equipment
 - ventilation equipment
 - portable radios or cellular phones
3. shall learn and become familiar with the operation of equipment such as the air monitors, tripod, harnesses, lifelines, portable radios, etc.
4. shall remain in communication with the attendant at all times in case there is a need to evacuate the confined space
5. shall alert the *attendant* whenever:
 - the entrant recognizes a dangerous condition or possible exposure
 - the entrant detects a prohibited condition
6. shall exit the confined space as quickly as possible whenever:
 - an order to evacuate is given by a “qualified” Williams College employee
 - the entrant recognizes a dangerous condition or possible exposure
 - the entrant detects a prohibited condition

Attendants:

7. shall be familiar with the known or potential hazards before entry and while entrants are working in the confined space - hazards may include:
 - equipment malfunctions
 - loss of communication
 - pedestrian and vehicle hazards
 - supply or exhaust ventilation shut-down
 - vehicle exhaust infiltration
8. shall maintain an accurate count of the *authorized* entrants in and out of the confined space and their well being
9. shall maintain constant communication with entrants of the confined space, monitoring for hazard exposure and behavioral abnormalities
10. shall monitor conditions in and around the confined space, using and interpreting the meter readings and alarms

11. shall warn unauthorized persons to remain clear of the confined space and immediately discharge those who may have already entered
12. shall remain immediately outside the “permit-required” confined space while occupied unless relieved by another qualified attendant
13. shall be familiar with initiating the rescue procedures for a confined space incident
14. shall be able to assist entrants from the confined space, either verbally or with the aid of the rescue retrieval equipment.
15. shall never enter a “permit required” confined space unless all hazards have been eliminated and *attendant* has officially been relieved by another qualified attendant

Emergency Protocol:

In the event of an emergency, the attendant should:

1. Immediately summon the Williams College Security Department, via the College supplied radio, for 911 activation. The rescue provider for all confined spaces on campus is the Williamstown Fire Department.
2. Attempt to remove the victim by use of the retrieval line from outside the confined space if this can be accomplished without creating further hazard for the entrant or the attendant.
3. If the attendant is able to remove the victim with the retrieval line, he/she should administer aid within the limits of his/her training until emergency medical services (EMS) 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 EMS personnel any information they request.

Training

The Office of Environmental Health & Safety will provide the initial and in-service training for all employees. All contractors hired to perform work in the College confined spaces are required to attend initial and an annual awareness session informing them of our written program. Permits are issued on a daily basis from the Office of Environmental Health and Safety. When at all possible, employees and contractors working for an extended period of time must provide a schedule of confined space work in order to facilitate the use of the equipment. Records of the training/awareness sessions shall be kept in the Office of Environmental Health & Safety as required.

Permits

Permits will be issued through the Office of Environmental Health and Safety at the beginning of each workday for that day's work or for a longer period depending on the requirements of the job. All permits must be terminated at the end of each job. If there are any unusual occurrences during an operation it must be so noted on the permit and reviewed prior to any future work in that location.

Before entry begins you must have a signed permit to authorize entry into a confined space area to work. The permit must be located at the entry to the confined space (or in another location visible to all employees). **No employees shall enter any confined space or electrical vault outlined in this written standard for any reason without a permit, or without an authorized attendant.**

If there is an emergency of any type in the confined space, employees will leave their work area and the permit becomes void. A new permit will have to be issued through the Office of Environmental Health and Safety before any employee can re-enter this space.

Appendix A: Definitions

Acceptable Entry Conditions - conditions that must exist in a confined space that allow for and ensure that employees involved in a confined space entry, can safely go into and work within the space.

Attendant(s) - one or more persons stationed outside a “permit required” confined space who monitors the authorized entrants, provides appropriate support services, assists in non-entry rescues and performs all other duties of the attendant as indicated herein.

Authorized Entrant - an individual who is authorized (with the appropriate knowledge and training) by the employer to enter a confined space, both permit and non-permit required.

Confined Space - a space that:

- 1) is large enough and so configured that an employee can bodily enter and perform assigned work.
- 2) has limited or restricted means of ingress or egress, such as, but not limited to: boilers, ductwork, elevator hoist ways, overheads and pits, stacks, tanks, tunnels, vaults.
- 3) is not designed for continuous occupancy.

Non-Permit Required Confined Space - a confined space that does not contain known or potential hazards (atmospheric or otherwise) that have the potential to cause serious illness, injury or death.

Permit Required Confined Space - a confined space that contains one or more actual or potential hazards that pose a threat to the health and safety of the workers who will enter the space and for which a written authorization to enter (a permit) is required. A PRCS has one or more of the following characteristics:

- a) contains or has the potential to contain a hazardous atmosphere
- b) contains a material that has the potential for engulfing an entrant
- c) 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
- d) has air, gas, steam or water under pressure
- e) is found to have excessively high temperatures that may cause dehydration
- f) has the potential to cause injury by electrocution
- g) contains any other recognized health and safety hazard

Entry - whenever a person places any portion of their body (i.e. arm, face, foot, hand or head) into the opening of a confined space, it is to be considered an entry.

Entry Permit - the printed or written document that is provided by Williams College to allow and control entry into a “permit required” confined space. The entry permit shall indicate all

appropriate, applicable information that will provide safe entry into a “permit required” confined space.

Entry Supervisor - the person responsible for determining if acceptable entry conditions are present at a “permit required” confined space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry or work in the space as required in these guidelines.

Hazard Evaluation – the assessment of a confined space to determine known or potential hazards.

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

- a) flammable gas, mist or vapor in excess of 10% of the lower explosive limit (LEL) or lower flammable limit (LFL)
- b) air-borne combustible dust at a concentration that meets or exceeds the LEL or LFL (the dust obscures vision at a distance of 5’ or less)
- c) atmospheric oxygen is below 19.5% or is greater than 23.5%
- d) hydrogen sulfide (odor of rotten eggs) in concentrations greater than 10 ppm
- e) carbon monoxide (colorless and odorless gas) in concentrations greater than 35 ppm
- f) any other substance that may exceed the exposure level (i.e. PEL, STEL or TWA)
- g) any other atmospheric condition that is immediately dangerous to life or health (IDLH)

Hot Work Permit – Williams College’s written authorization to perform operations such as burning, cutting, heating, soldering or welding that would be capable of providing a source of ignition.

Immediately Dangerous to Life and Health (IDLH) - any condition that poses an immediate or delayed threat to life or that which would cause irreversible adverse health effects or that would interfere with an individual’s ability to escape unaided from a confined space. (Check the MSDS or with the Office of EH&S for information on chemicals or gases that may be classified as IDLH.)

Isolation - the process of completely protecting or removing the release of energy and material into a confined space by such means as: blanking or blinding, misaligning or removing sections of ducts, lines or pipes, a double block and bleed system, lockout and/or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Lock Out/Tag Out - the placement of a lock and/or tag on an energy isolating device in order to separate the energy source(s), including potential or stored energy from the equipment, machine or process being maintained or serviced. (An energy isolating device is any device that prevents the transmission or release of energy, including but not limited to: blocks, circuit breakers, disconnects, line valves, etc...)

Qualified Person - a person who has the appropriate training to work in and around confined spaces and who is accomplished and knowledgeable in the various operations of confined space work. This includes, but is not limited to, having the ability to properly evaluate and recognize hazards that may be part of the confined space and having the ability to mitigate hazards found.

Retrieval System - equipment such as a full body harness, lifeline, rope and tripod used for non-entry rescue of persons from a confined space.

Testing - the identification and evaluation of hazardous conditions inside a confined space using equipment such as that which is used for monitoring hazardous atmospheres.

Toxic Atmosphere - the atmosphere in or around a confined space that contains a concentration of a substance (gas, liquid or solid) above the published or recognized safe levels.