Occupational Safety Program

Confined Space Entry Program

Manual

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Purpose

The purpose of this policy is to prevent injury to TU employees. It establishes minimum requirements and standards for safely entering confined spaces on campus. This procedure shall be used whenever a worker (TU employee or contractor) enters any space identified as being a confined space.

Scope

This procedure applies to all employees of Towson University. Whenever non-university contractors are working on campus engaging in activities covered by the scope and application of this procedure, they must directly coordinate with the Department of Facilities Management (FM). Facilities Management will ensure that all contractors comply with this policy unless their policy meets or exceeds the requirements presented in this document and is in full compliance with current OSHA/MOSH regulations. A copy of the contractors Confined Space Entry Policy will be provided to the Department of Environmental Health & Safety (EHS) for review at least 48 hours prior to work commencement. Otherwise, the contractor will comply with this policy. This standard does not apply to confined spaces in new construction areas, agricultural areas, or shipyards.

Definitions

ANSI *(American National Standards Institute):* A nonprofit organization that approves national safety standards.

Atmosphere*:* The gases, vapors, mists, fumes, and dusts contained within a confined space.

Attendant*:* A person trained in emergency rescue procedures and CPR and assigned to remain on the outside of the confined space and to be in constant contact with those working inside.

Authorized Entrant (Qualified Person)*:* A person designated by FM (or contractor), in writing, as capable (by education and/or specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a Permit-Required Confined Space.

Confined Space*:* A space which by design has limited or restricted means for entry and exit; has adequate size and configuration for employee entry to perform assigned work; and is not intended or designed for continuous employee occupation.

Emergency*:* A sudden and unexpected condition which could endanger entrants and requires immediate action.

Engulfment*:* The surrounding and/or effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system, or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry: The act by which a person intentionally passes through an opening into a Permit-Required Confined Space. The entrant is considered to have entered as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry Permit: A written or printed document that has been provided by the employer to allow and control entry into a permit space and that contains the required information.

Entry Supervisor: A person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and supervising entry operations, and for terminating entry as required.

Hazardous Atmosphere: An atmosphere that may expose employees to a risk of death, incapacitation, or impairment of ability to self-rescue (unaided escape from Permit-Required Confined Space), injury, or acute illness from one or more of the following causes: 1) flammable gas, vapor, or mist greater than 10 percent of its lower flammability limit; 2) airborne combustible dust (concentration may be approximated by condition where employee vision obscures at distance of 5 feet or less); 3) atmospheric oxygen concentration below 19.5 percent or above 23.5 percent; 4) atmospheric concentration of any substance for which a dose or permissible exposure limit is published in 29 CFR 1910 Subpart G (Occupational Health and Environmental Control) or 29 CFR 1910 Subpart Z (Toxic and Hazardous Substances), which could result in employee exposure in excess of its dose or permissible exposure limit; or 5) any other atmospheric condition that is immediately dangerous to life and health.

Hot Work: Any work involving burning, welding, cutting, riveting or similar fire producing operation, as well as work which produces a source of ignition such as drilling, abrasive blasting, and space heating. Workers require written authorization in the form of a Hot Works Permit prior to performing such work.

Immediately Dangerous to Life and Health (IDLH): Any condition which poses an immediate threat of loss of life, may result in irreversible or immediate severe health effects, may result in eye damage, or other conditions which could impair escape from the confined space.

Isolation: A process whereby the confined space is removed from service and completely protected against the accidental release of material or energy by the following: blanking off (use of skillet type metal blanks between flanges), misaligning sections of all lines and pipes, a double block and bleed system, electrical lockout of all sources of power, and locking or disconnecting all mechanical linkages.

Lower Flammability Limit (LFL): The minimum concentration of a flammable gas, vapor, or mist in air, usually expressed in percent by volume at sea level, which will ignite if any ignition source is present.

Non-Permit Confined Space: Any 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.

Oxygen-Deficient Atmosphere: Refers to an atmosphere containing less than 19.5 percent oxygen at normal atmospheric pressure. Normal air contains 20.9 percent oxygen.

Oxygen-Enriched Atmosphere*:* Refers to an atmosphere containing 23.5 percent or greater oxygen at normal atmospheric pressure.

Permissible Exposure Limit (PEL): The maximum 8-hour time weighted average of any airborne contaminant to which an employee may be exposed. At no time shall the exposure level exceed the ceiling concentration for that contaminant as listed in the OSHA Regulations (29 CFR 1910 Subpart Z).

Permit-Required Confined Space: Any confined space that exhibits one or more of the following characteristics: 1) contains, or has the potential to contain, a hazardous atmosphere; 2) contains, or has the potential to contain, a material that has the potential to engulf an entrant; 3) 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; 4) contains any other recognized serious safety or health hazard.

Purging*:* The method which gases, vapors, or other airborne impurities are displaced from a confined space.

Qualified Person (Authorized Entrant)*:* A person designated by the FM (or a contractor), in writing, as capable (by education and/or specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space.

Respirator: An approved respiratory device which meets NIOSH requirements and is designed to protect the wearer from inhalation of harmful atmospheres.

Retrieval System*:* Equipment (including a retrieval line, full body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from confined spaces. In Permit-Required Confined Spaces greater than 5 feet deep, a mechanical lifting device (hoist) must be used.

Toxic Substances/Toxic Contaminants*:* Any air contaminants regulated by 29 CFR 1910 Subpart Z or American Conference of Governmental Industrial Hygienists (ACGIH) as being hazardous to health and having designated standards for occupational exposures to which no worker should be exposed.

Responsibilities

A. Employee/Authorized Entrants

1. Comply with the procedures in this policy.
2. Report all unsafe or potentially dangerous conditions to their supervisor.
3. Know space hazards, including information on mode of exposure, signs and symptoms, and consequences of exposure.
4. Use appropriate personal protective equipment.
5. As necessary, maintain communications with attendants to enable attendant to monitor entrant status as well as alert entrant to evacuate.
6. Exit from the confined space as soon as possible when ordered by an authorized person, when the entrant recognizes the warning signs or symptoms of exposure, when a prohibited condition exists, or when an automatic alarm is activated.
7. Alert the attendant when a prohibited condition exists or when warning signs or symptoms exist.

B. Attendants

1. Comply with procedures in this policy.
2. Report all unsafe or potentially unsafe conditions to their Entry Supervisor.
3. Be present at all times outside of a Permit-Required Confined Space when someone is inside the permit confined space unless relieved by another authorized attendant.
4. Keep all unauthorized entrants out of the Permit-Required Confined Space.
5. Notify entrants of any changes in conditions which might create a new hazard or require entrants to exit the space.
6. Know existing and potential hazards, including information on the mode of exposure, signs or symptoms, consequences of the exposure, and their physiological effects.
7. Maintain communications with and keep an accurate account of those workers entering the Permit-Required Confined Space.
8. Order evacuation of the space when a prohibited condition exists, when a worker show signs of physiological effects of hazard exposure, when an emergency outside the space exists, and when the attendant cannot effectively and safely perform his required duties.
9. Summon rescue personnel during an emergency.
10. Inform authorized entrants and entry supervisors of entry by unauthorized persons.
11. Perform no other duties that interfere with the attendant's primary duties.

C. Entry Supervisors

1. Know the hazards that entrants may face, including symptoms, signs, and consequences of exposure.
2. Maintain a safe and healthy work environment (including supervising environmental monitoring in Permit-Required Confined Spaces).
3. Ensure that employees are aware of, are properly trained in, and follow the procedures for working in confined spaces as contained in this policy.
4. Comply with the procedures in this policy.
5. Report all unsafe or potentially dangerous conditions to their supervisor.

6. Verify emergency plans and specified entry conditions such as permits, test, procedures, and equipment before allowing entry.
7. Terminate entry and cancel permits when entry operations are completed or if a new condition exists.
8. Ensure that entry operations remain consistent with the entry permit and that acceptable entry conditions are maintained.

D. Department of Facilities Management (FM)

1. Maintain a safe and healthy work environment.
2. Identify those FM employees who could be potentially required to enter a confined space as a requirement of their job and provide a list to EHS. Provide EHS with changes to the list as often as they occur.
3. Identify Entry Supervisors and/or Authorized Entrants who will be responsible for ensuring safe work practices within Permit-Required Confined Space are being followed and who will be permitted to sign Confined Space Entry Permits (CSEP) and provide a list of those individuals to EHS.
4. Ensure the procedures in this policy are complied with by all FM and contractor supervisors and employees.
5. Ensure that all confined space entry employees are physically qualified to work in Permit-Required Confined Spaces and certify in writing that they are adequately trained. FM employee physicals shall be scheduled by EHS.
6. Identify and post warning signs at all Permit-Required Confined Spaces on campus and provide a list of all confined spaces to EHS.
7. Purchase all safety and atmospheric monitoring equipment necessary for safe worker entry into confined spaces.
8. Train employees in the field calibration, use, and maintenance of safety and monitoring equipment.
9. Immediately report all unsafe or potentially dangerous conditions to EHS.
10. Conduct an annual review of all Permit-Required Confined Spaces to determine if there were any: 1) changes in reported hazards; 2) unauthorized entries; or 3) any injuries or near misses.
11. Maintain all completed entry permits on record for one (1) year from the date of entry and provide a copy to EHS.
12. Maintain all personal training records, supervisory reviews, environmental testing results, and environmental monitoring equipment calibration results for three (3) years.

E. Department of Environmental Health & Safety (EHS)

1. To assist the campus community in maintaining a safe and healthy work environment.
2. Review and update this policy so that it is current with all regulations and technologies.
3. Conduct periodic audits to ensure that the procedures in this policy are being complied with.
4. Train identified TU employees in confined space entry procedures.
5. Develop in coordination with the FM specific hazard awareness and monitoring instrumentation training.
6. When requested, evaluate all unsafe or potentially dangerous conditions

existing within confined spaces.

7. Conduct an annual review of all Permit-Required Confined Spaces to determine if there were any: 1) changes in reported hazards; 2) unauthorized entries; and 3) any injuries or a near misses.
8. Coordinate medical monitoring for all TU employees to ensure that all who enter campus confined spaces are medically qualified to do so.

F. Fire Safety Manager/Department of Emergency Preparedness

1. To approve Hot Works Permits submitted by Facilities Management or Contractors who demonstrate that they have taken appropriate precautions prior to required work.

Introduction

OSHA defines a confined space as a space which by design has limited or restricted means for entry and exit, has adequate size and configuration for employee entry to perform assigned work, and is not intended or designed for continuous employee occupation. Work done within these spaces can be found in many different settings and professions such as welding, construction, maintenance, electric work or other utility work, plumbing, HVAC technician, manufacturing, mining, shipbuilding and marine work, and farming. Examples of confined spaces include, but are not limited to the following: boilers or hot water tanks, chimneys, commercial freezers, condensers, excavations deeper than four feet, furnaces, grain silos, heat exchangers, holes, kilns, ovens, pipelines, pits (surface or underground), process vessels, sewers, silos, storage tanks, tank rail cars, transformers, utility tunnels and vaults, vats, vehicle mounted tanks, ventilation and exhaust ducts, and wells. Work inside these areas often includes repairs/maintenance to the space itself, repairs/maintenance to machinery and utility lines that reside in or pass through them, inspections, or storage and transport of goods. The frequency and duration of entry into confined spaces will depend on the purpose, and multiple entrants may be present in a given space at once to complete tasks.

Confined space work is hazardous by its nature of confinement, but it can be compounded by other elements such as weather, the presence of hazardous materials, infrastructure related to energy (electricity, heat) and fluids (air, water, oil, steam, natural gas, other gases, etc.), biological activity, or other activity. Often spaces are underground or in relatively inaccessible areas, which could make a potential rescue more difficult. These spaces also tend to have a lack of natural ventilation, which could contain or produce dangerous air contaminants and a deficiency in oxygen. For these reasons, such confined spaces may be considered permit-required, which would require adding signage and posting relevant information the entry point, monitoring the atmosphere within the space and other conditions, posting the permit at the entrance, and having specific procedures for given operations in the space and for emergencies.

A Permit-Required Confined Space is defined as any confined space that exhibits one or more of the following characteristics: 1) contains, or has the potential to contain, a hazardous atmosphere; 2) contains, or has the potential to contain, a material that has the potential to engulf an entrant; 3) 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 4) contains any other recognized serious safety or health hazard. It is not a requirement for such a

space to have more than one hazard, though they often will. In this case, additional personnel such as an entry supervisor and attendant are required. These spaces require attendants outside the opening to monitor conditions inside the space for the authorized entrants through atmospheric monitoring. Attendants communicate with the entrants to check their status and to notify of any potentially hazardous conditions. Attendants are also outside the space keeping away unauthorized personnel and ready to contact rescue services should entrant(s) require this. The entry supervisor is a person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and supervising entry operations, and for terminating entry as required. This supervisor makes sure that all personnel are aware of the hazards in the space, trained on safety and monitoring equipment to be used, ensure that the valid permit is completed and posted, and that the authorized duration period is followed.

Applicable Regulations

- 29 CFR 1910.132 – General Requirements
- 29 CFR 1910.133 – Eye and Face Protection
- 29 CFR 1910.134 – Respiratory Protection
- 29 CFR 1910.135 – Head Protection
- 29 CFR 1910.136 – Foot Protection
- 29 CFR 1910.138 – Hand Protection
- 29 CFR 1910.140 – Personal Fall Protection Systems
- 29 CFR 1910.145 - Specifications for Accident Prevention Signs and Tags
- 29 CFR 1910.146 – Permit-Required Confined Spaces
- 29 CFR 1910.147 – Control of Hazardous Energy (Lockout/Tagout)
- 29 CFR 1910.1030 – Bloodborne Pathogens
- 29 CFR 1926.500 – Fall Protection
- 29 CFR 1926.1200-1213 – Confined Spaces in Construction

Procedure

A. Classification Criteria

1. A designated space must be determined to be a confined space for the procedure to apply. A confined space must have all three of the following criteria to apply:
   a) By design has limited or restricted means for entry and exit;
   b) Has adequate size and configuration for employee entry to perform assigned work; and
   c) Not intended or designed for continuous employee occupation.
2. Procedures to be followed for entry into the confined space are dependent upon the hazards identified and/or anticipated to be present in the space, per OSHA.
3. Each confined space has specific combinations of potentially hazardous situations which must be evaluated before the space may be entered and work begun.

4. It is extremely important that each space is properly assessed and classified for hazards. Classification of the degree of hazard shall be based upon the levels of oxygen, flammable gas or vapors, toxic substances, and airborne combustible dust, in addition to other health and safety hazards, according to the following:
    a) Permit-Required Confined Space
       A confined space that has one or more of the following characteristics:
        i. *Contains or has the potential to contain a hazardous atmosphere.*
        ii. *Contains a material that has the potential of engulfing an entrant.*
        iii. *Has an internal configuration such that the entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.*
        iv. *Contains any other recognized serious safety or health hazard.*

    b) Non-Permit Confined Space
        i. *Any space which meets the definition of a confined space and does not meet any of the four characteristics listed above.*

    c) Permit-Required Confined Space with Alternate Procedures
        i. *Meets the definition of a confined space.*
        ii. *The only present hazard is that it contains or has the potential to contain a hazardous atmosphere, and*
        iii. *The atmospheric hazard(s) can be controlled by ventilation.*

5. Once the determination of the confined space is complete, procedures for entry will be as follows:
    a) For Permit-Required Confined Spaces, a permit is required that details the following information:
        i. *Confined Space ID/Type*
        ii. *Confined Space Location*
        iii. *Task/Purpose of Entry*
        iv. *Authorization Duration Period*
        v. *Authorized Entrants*
        vi. *Authorized Attendants*
        vii. *Hazards Present*
        viii. *Entry Preparation and Procedures Required*
        ix. *Safety Equipment Required for Entry & Work*
        x. *Atmospheric Testing Record*
        xi. *Authorization by Entry Supervisor*
    b) For Permit-Required Confined Spaces with alternate procedures, limited entry is allowed to do work. No permit is required, no attendant, and no rescue provisions are required (though recommended by EHS), but the following actions are required:
        i. *Certification, complete with testing, should take place prior to entry.*
        ii. *Initial and continuous atmospheric monitoring and testing. Tests are to take place at least every two hours.*
        iii. *Test at top of space and at every four feet until the bottom. If atmosphere is found to be unsafe, ventilate and purge, then retest.*

iv. Continuous forced air ventilation must be used to eliminate or control atmospheric hazards.

c) For non-permit confined spaces, no permit is required.

6. The National Institute of Occupational Safety & Health (NIOSH) defines a confined space by the level of hazard that they present and categorizes the levels into three classes:
   a) Class A, which is immediately dangerous to health (IDLH);
   b) Class B, which is dangerous, but not IDLH; or
   c) Class C, which is potentially hazardous.

   The classes are based on the difficulty in entry into the space, performing work, and exiting the space. Note: Employees will comply with Step C – Atmospheric Monitoring for testing.

Table 1. NIOSH Confined Space Classification

	Class A	**Class B**	**Class C**
Characteristics	IDLH	Dangerous, but not IDLH	Potentially hazardous
Oxygen	≤ 16%* or ≥ 25%	16.1-19.4%* or 21.5-25%	19.5-21.4%*
Flammability	≥ 20% of LFL	10-19% of LFL	≤ 10% of LFL
Toxicity	IDLH	Greater than contamination level, in 29 CFR 1910 Subpart Z, less than IDLH	Less than contamination level, in 29 CFR 1910 Subpart Z

*Based on total atmospheric pressure of 760 mmHg (at sea level)

B. TU Permit-Required Confined Spaces

1. The following is a list of the currently identified Permit-Required Confined spaces at TU. **<u>This list is not complete</u>**. There may be other Permit-Required Confined Spaces which have not yet been identified. If additional confined spaces are identified, **<u>prior to entry</u>**, the space must be examined and properly classified. For additional guidance, See Appendix E. If desired, EHS can provide assistance in the investigation and classification process. This hazard classification of known Permit-Required Confined Spaces on the TU campus is conservative and was made based upon the best available information and may be re-classified upon re-evaluation.

Table 2. TU Permit-Required Confined Spaces Inventory (Limited)

Location	**Description**	**Quantity**
Burdick Hall	Hot Water Tank	1
Glen Complex (Towers A, B, C, D)	Hot Water Tank	8
Hawkins Hall	Hot Water Tank	1
Johnny Unitas ® Stadium	Underground Storage Tank	1
Linthicum Hall	Hot Water Tank	1
Newell Hall	Hot Water Tank	1
Power Plant	Boiler	3
	De-Aerator Tank	1
	Exhaust Stack	1
	Surge Tank	1
	Underground Storage Tank	2
Prettyman Hall	Hot Water Tank	1

Residences at 10 West Burke Avenue	Hot Water Tank	ALL
Science Complex	Hot Water Tank	1
Stephens Hall	Hot Water Tank	1
Towson Center	Hot Water Tank	2
	Underground Storage Tank	2
Campuswide	Communications Manholes	ALL (~24)
	Confined Spaces Which Contain Damaged ACM	ALL
	Electrical Manholes	ALL (~41)
	Sanitary Sewer Manholes	ALL
	Steam Manholes	ALL
	Steam Tunnels	ALL
	Stormwater Manholes	ALL
	Water Manholes	ALL
Potential Confined Space Areas	See Appendix G	

C. Atmospheric Monitoring

When continuous, forced ventilation is necessary to achieve and maintain safe levels of oxygen, flammable gases, and/or toxic substances, continuous monitoring for the hazardous condition(s) shall be performed throughout the time the confined space is occupied. Monitoring instrumentation should be approved in advance by EHS and shall be equipped with audible alarms.

Where continuous ventilation is not possible, prior to entry, the atmosphere shall be tested until the initial ventilation achieves safe conditions. The following tests will be performed in sequence:

1. Monitor for the presence of oxygen at concentrations between 19.5% and 23.5%. Concentrations of oxygen less than 19.5% or greater than 23.5% are dangerous and spaces will not be entered while these conditions exist.

2. Monitor for the presence of flammable gases and or vapors at less than 10% of the LFL (Lower Flammability Limit). Spaces with flammable gases/vapors at concentrations greater than or equal to 10% of the LFL will not be entered while these conditions exist.

3. Monitor for the presence of toxic vapors and/or gases such as hydrogen sulfide (H_2S), carbon monoxide (CO), and any other contaminants which may be already in the space or may be introduced into the space by the entrants. Both hydrogen sulfide and carbon monoxide are toxic gases. Spaces which contain greater than 35 parts per million (ppm) of carbon monoxide or greater than 10 ppm of hydrogen sulfide will not be entered while these conditions exist. Other potentially toxic gases such as ammonia (NH_3), chlorine (Cl_2), and sulfur dioxide (SO_2) will be monitored on an individual basis. Under no conditions will spaces be entered when concentrations of toxic materials are greater than or equal to the American Governmental Industrial Hygienists Threshold Limit Value (ACGIH TLV) or the Occupational Health & Safety Administration Permissible Exposure Limit (OSHA PEL), whichever is lower.

4. Gases and vapors may migrate to different heights (depths) within the

confined space dependent upon their respective vapor density compared to air. The heavier the molecule, the more likely it is to reside on the bottom of the space. Lighter gases such as methane may be closer to the top of the confined space, carbon monoxide is approximately the same size and weight as oxygen or air and found in the same space, and larger molecules like hydrogen sulfide are likely to reside closer to the bottom of the space. This emphasizes the importance of measuring gas/vapor concentrations at different depths.

5. Spaces which contain damaged asbestos or Asbestos Containing Materials (ACM) will only be entered by trained Level II employees wearing the appropriate personal protective equipment. (See Step D - Ventilation in Procedure and Step I - Asbestos Containing Materials in Appendix A).

6. Spaces will not be entered when airborne combustible dust is greater than or equal to the LFL. This concentration may be approximated to a condition where the dust reduces visibility to a distance of five (5) feet or less.

7. Spaces will not be entered if there are any other atmospheric conditions that are immediately dangerous to life or health.

Entry shall be made after the safe conditions are maintained for three (3) tests conducted at five-(5)-minute intervals. Thereafter, monitoring shall be of a continuous nature. If there are any questions concerning potentially toxic environmental conditions within a Permit-Required Confined Space, EHS is available to assist. If there are any questions during normal duty hours, contact EHS at 410-704-2949. At all other times, EHS personnel may be contacted through the TUPD at 410-704-4444.

All atmospheric monitoring test results must be recorded on the confined space entry permit posted at the entrance to the confined space. In addition, all test results must be recorded on a daily log that will be made available for inspection by state or federal agencies. The entrant must also be afforded an opportunity to see all test results during the operation.

D. Ventilation

The classification of confined spaces is based upon the assessment of hazardous conditions including hazardous atmospheres, which must be ventilated, if possible. Only ventilation equipment approved for use in potentially explosive atmospheres may be used when combustible gases are detected. Exhaust systems shall be designed to protect workers in the surrounding area from contaminated air. The method used for purging and ventilation will be determined by the potential hazards that arise due to the product stored or produced, suspected contaminants, the nature of the work to be performed, and the size, shape, and number of entrances into the confined space. Atmospheres within Permit-Required Confined Spaces may be dynamic, including when under ventilation, due to factors such as temperature, humidity, pressure, and the physical and chemical properties of the hazardous substances in the atmosphere. If deemed necessary, ventilation equipment will

be put in place and operate after initial testing and be used in concert with continuous monitoring/testing.

Gasoline-powered ventilation blowers must use either remote clean air intakes or remote engine exhausts to prevent the accidental introduction of carbon monoxide into the confined space from blower motors. Ventilation blowers should be positioned such that the engine exhaust is downwind from the remote clean air intake. Care should be taken in positioning the clean intake so that other potentially toxic contaminants are not accidentally introduced into the confined space.

Forced ventilation shall be maintained where toxic atmospheres are produced as a part of a work procedure, or where a toxic atmosphere may develop due to the nature of the confined space, as in the case of desorption from walls, evaporation from residual chemicals, welding, dust-producing operations, high ambient temperature and humidity, or other operations which utilize materials regulated under the Maryland Hazard Communication Standard. General ventilation is an effective procedure for distributing contaminants from a local generation point throughout the workspace to obtain maximum dilution. **FORCED VENTILATION WILL NOT BE USED IN THE PRESENCE OF ANY DAMAGED ACM, <u>EXCEPT</u> IN STEAM TUNNELS/MANHOLES ONLY FOR THE PURPOSE OF REDUCING THE AMBIENT ENVIRONMENTAL TEMPERATURE PRIOR TO ENTRY.** Contact EHS for guidance.

Special precautions shall be taken if the ventilating system partially blocks the exit opening. These precautions include a means of supplying "breathable air" (Grade D, Compressed Gas Association Commodity Specification G-7.1-1966) to each worker for the time necessary to exit the space and a method for maintaining communication. This may be accomplished by using either NIOSH-approved Self-Contained Breathing Apparatus or other form of approved supplied air respiratory protection device.

Local exhaust ventilation shall be provided when general ventilation is not effective due to restrictions in the confined space or when concentrations of contaminants occur in the breathing zone of the worker. Localized high concentrations of contaminants may occur during work activities such as welding, painting, and chemical cleaning. Regardless of the means of ventilation, the entrant must be provided sufficient time to safely exit the space once ventilation stops.

E. Hot Work

1. When open flames are used in a confined space, the following precautions shall be taken to protect the workers against the accumulation of toxic or flammable gases and vapors:
   a) A test for flammable gas shall be made immediately before using the open flame device, and at least once per hour while using the device.

   b) The fuel tank shall not be taken into the confined space. Unless part of a respiratory protection device (i.e., self-contained breathing apparatus,

etc.), compressed gas cylinders shall not be taken into confined spaces.

c) Remove all combustible materials from the floor and/or surrounding area.

d) Flammable materials that cannot be moved must be protected with a noncombustible material or non-asbestos fire retardant cover.

e) All openings to lower-level spaces will be tightly covered to prevent accumulation of "heavy" flammable gases and/or vapors. Ventilation hoses should be located to minimize accumulation of these gases in low areas. **Note**: Use only approved explosion-proof ventilation equipment when ventilating flammable gases and vapors.

f) A worker must be assigned the specific responsibility of watching for sparks and associated fires in and around the work area and sounding the alarm in the event of an emergency. A responsible individual with a reliable means of communication (e.g. two-way radio) will remain on site with an approved dry chemical fire extinguisher for 30 minutes after completion of the work to ensure there are no smoldering fires present. In the event of a fire, dial 911. At the emergency blue-light and yellow phones located around campus, press the emergency button to be connected to TUPD who can contact 911 for you, or dial 911 on the keypad to be connected directly to the 911 Center. Give the dispatcher all of the requested information.

g) An approved dry chemical fire extinguisher will be on site at all times.

h) All flame/spark-producing equipment that is to be utilized in the confined space will be inspected by the workers and not utilized if unserviceable.

i) The sprinkler system in the space, if so equipped, is in service and functioning properly.

j) Appropriate coordination has been made with EHS if there is the possibility of false alarming of smoke or heat detectors in the area, if present.

k) There are no flammable liquids or vapors, explosive dusts or lint, or any containers or equipment that previously contained these materials in the confined space.

2. Prior to the beginning of <u>any</u> hot work in a confined space, a "Hot Works Permit" will be issued, (see Sample in Appendix B). The supervisor and/or "qualified person" will ensure the items listed have been accomplished and both the job foreman and the FM Supervisor and/or "qualified person" will sign the form. The intent of this permit is not to impede work but to serve as a checklist to ensure all safety precautions are being followed during this

potentially dangerous procedure. The top copy of this form will be retained on the job site and the bottom copy will be forwarded to EHS.

F. Other Hazards & Controls

In addition to atmospheric hazards, other hazards may exist within confined spaces that will make them permit-required to do work. The hazards may arise from the environment meaning the space itself, its interior or exterior use, or the surface(s) adjacent to it; the use or failure of work equipment in the space; or operator error/issues in reference to the authorized entrant or attendant. Because of the limited interior of confined spaces, the hazards and their effects are likely to be increased and often will be combined with other factors. Elimination or control of the hazards is a requirement to enter and perform work.

One of the elements of a confined space, "not designed or intended for continuous human occupancy", lends itself to hazardous environmental conditions. There may be poor lighting or visibility, if any, which may lead to injury; temperature and humidity extremes, leading to thermal hazards (heat/cold stress injuries), especially with long duration of work; little or no ventilation, which itself may be hazardous and contribute to hazards associated with temperature and humidity, in addition to insufficient air/oxygen to breathe; dampness from weather or infrastructure (leaks, flood, condensation, etc.), which may contribute to slips or water-related hazards; or other physical hazards not listed.

These conditions, however, may be suitable for other living species to thrive. Biological hazards may arise from animals, pathogens (e.g. bacteria, mold/fungi, viruses, etc.), or related allergens, any of which may lead to acute or chronic health problems. Many species or their biological decay will increase biological oxygen demand in such a space, which will simultaneously create oxygen deficiency and production of toxic and/or asphyxiating gases such as ammonia (NH_3), hydrogen sulfide (H_2S), methane (CH_4), carbon dioxide (CO_2), and nitrogen (N_2). Pathogens may exist in confined spaces with aerobic (with air) or anaerobic (without air) conditions.

While the spaces may be used for a specific purpose, the work assigned for the authorized entrant may be for a different reason (i.e. a vessel or area used for storage may need to be cleaned by the entrant). There may be a danger of engulfment in liquid or loose flowing materials, if the space is connected to water-carrying infrastructure, it is in an area that may flood due to weather or depth underground where an entrant may be submerged, or it is designed to store or carry other materials. The actions of the entrant(s) may influence exposure to said hazards. Dependent on the space, the entrant may walk, crawl, climb, or be lifted and lowered by harness, each of which may increase contact with surfaces or lead to a fall hazard, which is a primary physical hazard in confined space work. If the space is a vertical hole, objects may accidentally be dropped into it. There may also be restrictions in height, danger of entrapment because of the internal dimensions of the space, or other physical

limitations for movement to consider (e.g. additional clothing or equipment worn).

The reasons for entrant(s) to perform assigned work in the confined space often increase the hazards that exist in said spaces. Reasons for performing work in confined spaces may include but are not limited to the following:

1. Utility Maintenance/Repairs
    a) Wiring, conduit, or electrical/mechanical devices
    b) Culverts, pipes, & plumbing (potable water, stormwater, sewage, other liquids; air, natural gas, steam, other gases; vacuum)
    c) Data/communications wiring and devices
    d) Ductwork and related devices (heating, ventilation, air conditioning)

2. Maintenance/Repair of Confined Space
    a) Clearing debris to prevent blockage
    b) Cleaning/washing tanks
    c) Painting/sealing cracks or damage
    d) Sanding or scraping
    e) Drilling
    f) Removing floodwater
    g) Remediation/removal of ACM or other hazardous materials

3. Inspections, Monitoring/Checking Conditions

These tasks will typically involve controlling hazardous energy in the form of electricity (high current/voltage), pressure from gas or liquid, mechanical moving parts or machinery, through lockout/tagout (LOTO) and other forms of isolation (to be discussed in the Procedure Step M – Hazardous Energy Isolation, Lockout, & Tag Out.) Without mitigation, heat stress, burns, cuts/trapped body parts, electrocution, electrical arc flash, asphyxia, fire, explosion, or other results may occur. Any work involving atmospheric hazards will involve ventilation as covered prior. Notification of affected individuals (employees who may be doing work in the area, including contractors, and other personnel who depend on the processes involving with out-of-service equipment) is a requirement prior to performing work.

Work equipment can contribute hazards in different ways. Due to the enclosed nature of the space, gases and sparks generated in Hot Work (e.g. welding/cutting/brazing) can lead to respirable dust hazard, high heat hazard, radiation (in the form of ultraviolet light), other acute toxicity, asphyxia, corrosive irritants, fire, or explosion. For this reason, all devices and equipment used in the space must be explosion-proof or intrinsically safe as equipment that does not meet this requirement will contribute to an electrical, fire, or explosion hazard, in addition to ventilation. Good examples include two-way radios, flashlights, and meters for monitoring gases. Mechanical equipment in the surroundings near the space or that is being used to perform work may contribute to noise hazards, so this should be addressed prior to entry. The design of the space will affect the acoustics of the space, which may increase the hazardous effect of the noise, including vibration, on the entrant.

Hazards arise from equipment failures as well. Communication devices may lose a wireless connection, batteries may lose charge or fail, or the device may become otherwise erratic, damaged, or lost. Some hazards may be unavoidable, but items should be checked prior to use and spare equipment maintained and kept nearby in such an instance. More serious problems can happen if not properly securing a harness or its attached hoist/cable (or other rescue equipment), wearing PPE that is too loose/tight, or respiratory devices which are not secure or not operational/activated. As mentioned above, objects dropped into a vertical hole can be an issue; this includes equipment, which may be portable or hanging by a wire. The equipment could become damaged and hazardous for the entrant(s).

In addition, the actions of the attendant(s) may also contribute to hazards. For example, if the attendant is not monitoring the area for bystanders or passersby, those unauthorized individuals may accidentally enter the space or enter into a hazardous environment surrounding it. This may lead to a fall or accidental asphyxiation or being overcome by a toxic atmosphere by said individuals. Barriers and signage should also be in place prior to work to decrease the likelihood of this occurrence. If communication fails due to equipment (power loss/dead batteries; device failure; device loss), the attendant leaves space without a replacement, or a separate issue, this could also lead to problems for the entrant or unauthorized individuals entering the area.

Psychological hazards also exist, wherein entrants may have claustrophobia or a fear of being trapped or enclosed due to confinement in the space. This may lead to symptoms such as increased heart rate and breathing, or frantic behavior that causes injury. There may be panic from fellow workers, such as the attendant, if there is a lack of communication, which leads to them rushing into the space without the proper equipment. This should be avoided if the current conditions within the space are not understood.

G. Training

Facilities Management (FM) will identify those employees who could potentially have to enter any confined space as a requirement of their job and ensure that the employees are aware of, are properly trained in, and will follow the procedures for working in confined spaces as outlined in this procedure. A list of those trained employees will be maintained by FM and EHS and updated whenever there is a change. If requested, EHS is available to assist in providing confined space training to FM employees. A written record of confined space training must be on file for each employee who enters into a confined space, attends an occupied confined space, or supervises workers who enter or function as attendants in confined spaces.

FM will ensure that the persons responsible for monitoring for oxygen, flammable gases and/or toxic substances are trained in hazardous communication and awareness, and in the field calibration, use, and maintenance of safety and monitoring equipment. All persons working in

Permit-Required Confined Spaces shall be trained by FM supervisory personnel for work in that particular type of confined space by use of practice drills. Work to be performed in the confined space is to be reviewed and practiced outside the space before entry may occur. Included in this review will be practice in all non-verbal communication (hand signals) to be used inside the space as well as review of rescue procedures to be implemented in case of emergency.

Facilities Management will ensure that all workers involved in confined space work are trained and certified annually in cardiopulmonary resuscitation (CPR), are trained in how to summon emergency assistance, and are trained in the use of emergency communications equipment. CPR training to FM employees may be provided through TU College of Health Professions, TU Campus Recreation, other TU-affiliated trainers, or other accredited CPR training provider. Training should involve hands-on learning. Trainees should be certified prior to Confined Space Entry work. CPR certifications are valid for two years after certification date. Employees should maintain training documentation, be able to provide documentation (such as a card or certificate) upon request, and provide a photocopy to FM and EHS to keep on file. FM will also ensure that all workers involved in confined spaces and trained in CPR are trained annually on the University's Bloodborne Pathogens Program (BBP) through EHS.

Workers shall request training for Confined Space Entry through EHS by emailing safety@towson.edu or by calling at 410-704-2949.

For training in BBP, Lockout/Tagout, Heat Illness Prevention, Respiratory Protection, Hearing Loss Prevention, and other occupational safety, it will be assigned virtually through Vector Solutions SafeColleges found at the following URL: https://towsonehs-md.safecolleges.com/training/home. Workers shall request training by emailing safety@towson.edu or by calling the Environmental Health & Safety (EHS) office at 410-704-2949.

H. Personal Protective Equipment

At a minimum, powered-air purifying respirators (PAPRs) with high-efficiency particulate air (HEPA) cartridges and Tyvek® (or approved equivalent) protective clothing will be utilized when entering all confined spaces containing, or suspected of containing, damaged ACM. Such respirators are only approved for use in atmospheres with sufficient oxygen. PAPRs only work to remove aerosol or particulate contaminants, they do not significantly increase oxygen content in the air that is inhaled. If other toxic contaminants or substances are present in harmful concentrations, supplied air respirators approved by EHS must be utilized.

As long as safe, non-hazardous breathing atmospheres are maintained in Permit-Required Confined Spaces through the use of local exhaust ventilation or natural ventilation, there is no need for respiratory protection devices. However, workers may be allowed to wear respiratory protection devices (RPD) at their discretion for protection against nuisance dusts (other than ACM) and

odors. Regardless, any employee wearing any type of RPD must be enrolled in the TU Respiratory Protection Program coordinated by EHS. If localized areas of toxic dusts, fumes, mists, gases, or vapors are created when welding, burning, or painting, the appropriate RPD must be worn in the space unless local exhaust ventilation is used to remove the contaminant at the point of generation.

If noise-producing powered equipment such as drills, jackhammers, etc. are to be utilized in confined spaces, all employees must wear EPA-approved hearing protection devices with a Noise Reduction Rating (NRR) of at least 25 and ANSI-approved, impact-resistant eye protection. Workers exposed to high noise levels in the work area should be enrolled in the TU Hearing Conservation Program, which is coordinated by EHS. Approved hard hats will be worn when entering all confined spaces.

Authorized entrants must use a full-body harness with a retrieval line attached at the center of the entrant's back (near shoulder level) or above the entrant's head. Wristlets may be used in place of the full-body harness if it can be demonstrated that harness use creates a greater hazard, and that wristlets are the safest and most effective alternate. The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space, so that rescue efforts may begin as soon as possible. In vertical spaces greater than 5 feet in depth, a mechanical retrieval device (i.e., tripod & hoist) must be utilized.

I. Labeling, Posting, & Barricading

All openings to Permit-Required Confined Spaces shall be covered to prevent accidental entry and prominently posted/labeled as follows:

DANGER
PERMIT REQUIRED
CONFINED SPACE
DO NOT ENTER
FACILITIES MANAGEMENT
(410) 704-2481

All uncovered openings to Permit-Required Confined Spaces shall be barricaded and prominently posted as above. Warning signs will be constructed in accordance with 29 CFR 1910.145.

Barricades will be highly visible, 42" tall, and capable of withstanding a minimum load of 200 pounds applied in any direction. Additional requirements pertaining to barricades as outlined in 29 CFR 1926.500 will be followed to be in compliance. In addition, confined spaces which contain ACM will be barricaded in accordance with Step I, Asbestos Containing Materials in Appendix A.

J. Emergency Procedures

All persons should be familiar with procedures for emergency escape and rescuing a disabled individual from a confined space. Lifelines must be

available at all times and shall not be used for any non-rescue purposes. Employees working in confined spaces shall have a direct, reliable means of summoning emergency assistance (i.e. intrinsically safe, two-way radio) at all times.

Rescue services must be informed by employees of the hazards that may be encountered in the space and provided access to permit spaces in order to develop rescue plans and practice operations. This may be coordinated with Facilities Management and EHS. TU must assure that the rescue service is aware of hazards to be encountered, able to recognize/respond to said hazards, and rescue a victim in time to affect a rescue.

In the event of any potentially life-threatening emergency within a Class A or Class B confined space (per NIOSH), dial 911. At the emergency blue-light and yellow phones located around campus, press the emergency button to be connected to the TUPD who can contact 911 for you, or dial 911 on the keypad to be connected directly to the 911 Center. Give the dispatcher all of the requested information. The Baltimore County Fire Department (BCFD) is the primary rescue team for all Permit-Required Confined Spaces on campus. TUPD will immediately notify EHS of any confined space emergencies (the 911 Center will notify the TUPD).

K. Medical Monitoring

Facilities Management shall provide EHS with a current list of all employees who have the potential to enter any confined space as a requirement of their job. EHS is responsible for scheduling all medical monitoring. Presently, the only requirement for medical monitoring of employees working in confined spaces pertains to the use of respiratory protection equipment. Employees who are not qualified to wear respiratory protection equipment are not qualified to work in Permit-Required Confined Spaces, which contain toxic substances and contaminants that cannot be corrected by ventilation or which contain damaged ACM. They may only work in non-permit required (e.g. non-hazardous) confined spaces. Employees who are exposed to high noise levels while working in confined spaces will be enrolled in the TU Hearing Conservation Program which is coordinated by EHS.

L. Supervisory Review

Before permitting work in Permit-Required Confined Spaces, a FM Supervisor and/or a Qualified Person will review with employees the specific guidelines for safe entry and exit. The Supervisor will allow no employee to work in a confined space until they are sure the employee is familiar with all the procedures. It is recommended that Supervisors maintain a log listing the date, time, and names of workers present for the review.

M. Hazardous Energy Isolation, Lockout, & Tagout

Prior to entering any confined space, lockout/tagout procedures must be completed as specified in the TU Lockout/Tagout Program.

N. Cleaning Confined Spaces, Boilers, & Tanks

Procedures and processes used by either TU employees or contractors for cleaning confined spaces or the inside of storage tanks shall be reviewed and approved by EHS prior to the commencement of any work. The method shall be based on the contents of the space or tank. Initial cleaning shall be done from the outside of the space or tank, if possible. **Requests for approval must be provided to EHS at least 48 hours in advance.**

Special procedures shall be adopted to handle the hazards created by the cleaning process itself. For example, if the confined space is a tank and it is to be steam cleaned, it should:

1. Be allowed to cool prior to entry;
2. Be ventilated during neutralization procedures to prevent the buildup of toxic materials;
3. Not be steam cleaned if the original contents were liquids with an auto-ignition temperature of 120^{o}F, or less than the temperature of the steam; and
4. Be grounded to the nozzle or pipe to decrease the generation of static electricity that could accumulate in the tank as a result of the steam cleaning process.

O. Equipment & Tools

Any tools or equipment used in a confined space shall be carefully inspected and shall meet the requirements set forth by 29 CFR 1910.241 through 29 CFR 1910.246. As a minimum:

1. Matches or other open flame devices shall not be utilized in confined spaces as illumination.
2. Compressed gas cylinders shall not be taken into a Permit-Required Confined Space. They shall be turned off at the cylinder valve when not in use. Cylinders that are a part of a respiratory protection device are exempt from this requirement.
3. All equipment that may be used in a flammable atmosphere shall be approved as explosion-proof or intrinsically safe for the atmosphere involved by a recognized testing laboratory such as United Laboratories (UL) or Factory Mutual (FM).
4. Wherever possible, intrinsically safe low voltage (12 volt) lights and power tools will be used in confined spaces. If this is not possible or practical, GFCIs will be utilized on all extension cords and power lines brought into the confined space where water or detectable moisture is present. (National Electric Code, Article 305-6; 29 CFR 1926.404)

P. Recordkeeping

A written record of all personnel training, supervisory reviews, environmental testing results, and monitoring instrument calibration shall be maintained for three (3) years from the date trained or calibrated. In the event of separation of the employee or disposal of the equipment, records may be disposed of after one (1) year. Records shall be immediately available for inspection at all times. Where atmospheric testing indicates the presence of a toxic substance, records will be

maintained by EHS in accordance with existing federal and/or state regulations. These records shall include, as a minimum:

1. Date, time, and location of measurement;
2. Names and duties of employees in the confined space;
3. Sampling and analytical methods used;
4. Number, duration, and results of samples taken;
5. Types of personal protective equipment used, if any; and
6. Other comments as required.

Q. Contractors

When non-university workers are required to enter or work in TU confined spaces, they shall comply with this policy. It shall be the responsibility of Facilities Management to coordinate with contractor personnel to inform them of TU's Confined Space Entry Program, any known hazards, any past experiences with the space(s), precautions, and entry procedures to be followed, and actions to be taken in case of an emergency. FM will also ensure contractor personnel comply with these procedures. The **only exception** to this requirement is if the contractor has their own confined space policy in effect and it has been reviewed and approved by EHS in advance. Any delays in work resulting from non-compliance with this policy shall be the contractors' responsibility.

In the event of an emergency which requires rescue, fire or medical assistance, contractor personnel shall dial 911. At the emergency blue-light and yellow phones located around campus, press the emergency button to be connected to TUPD who can contact 911 for you, or dial 911 on the key pad to be connected directly to the 911 Center. Give the dispatcher all of the requested information. For police or other emergencies, immediately contact the TUPD at x4-4444 from any campus phone or from other phones, dial (410) 704-4444. TUPD will immediately dispatch the required assistance.

Resources

A. Request Training

Employees shall request training for Confined Space Entry through EHS by emailing safety@towson.edu or by calling at 410-704-2949. Employees may be enrolled into TU Hearing Conservation Program through EHS and receive annual audiograms to test hearing if exposed to regular noise hazards in confined spaces. Requests for annual fit tests for respirators may also be scheduled and performed through EHS with registration (no fit test is required for the use of PAPRs).

For training in BBP, Lockout/Tagout, Heat Illness Prevention, Respiratory Protection, Hearing Loss Prevention, and other occupational safety, it will be assigned virtually through Vector Solutions SafeColleges found at the following URL: https://towsonehs-md.safecolleges.com/training/home. Workers shall request training by emailing safety@towson.edu or by calling the Environmental Health & Safety (EHS) office at 410-704-2949.

For CPR training, contact TU College of Health Professions, TU Campus Recreation, other TU-affiliated trainers, or other accredited CPR training provider. Training should involve hands-on learning. Trainees should be certified prior to Confined Space Entry work. CPR certifications are valid for two years after certification date. Employees should maintain training documentation, be able to provide documentation (such as a card or certificate) upon request, and provide a photocopy to Facilities Management and EHS to keep on file.

For training on specific safety and monitoring equipment, contact Facilities Management at 410-704-2481.

B. Requests for Documentation, Reviews, or Approvals

To request document/policy reviews or procedure/process approvals (for contractors or FM personnel), equipment reviews or approvals, or general inquiries, contact EHS by emailing safety@towson.edu or by calling the Environmental Health & Safety (EHS) office at 410-704-2949.

For permits (CSEP), tests, or documentation for operations in confined Spaces, contact Facilities Management at 410-704-2481.

Appendix A: Entry Into Permit-Required Confined Spaces

A. Entry Precautions

1. Entry into a Permit-Required Confined Space is prohibited until FM and EHS supervisory personnel have been notified. Entry procedures are summarized on the Confined Space Decision Flow Chart as shown on Appendix E.

B. Confined Space Entry Permit (CSEP)

1. A CSEP shall be completed by a FM Supervisor prior to entering any Permit-Required Confined Space and prior to re-entry after two or more hours of non-occupancy. The CSEP is a checklist that will be used to ensure that all precautions have been observed prior to entry. This CSEP will include all considerations for entry, working in and exiting from Permit-Required Confined Space. A sample CSEP may be found in Appendix C.
2. The CSEP shall be posted in a conspicuous place near the portal of entry used for entering the confined space. Where this is not practical, the CSEP shall be in immediate possession of the on-site Attendant, with the stipulation that the Attendant not enter the confined space.
3. This CSEP shall be kept on file with FM for a minimum of one (1) year from the date of issue and shall be made available to EHS or other authorized federal or state agencies upon request. A copy shall be provided to EHS.

C. Monitoring

1. Continuous monitoring for flammable gases shall be employed whenever flammable gas levels exceed 10% LFL or if conditions exist which may cause the 10% LFL to be exceeded during employee occupancy of the space.
2. Continuous monitoring for oxygen shall be employed whenever oxygen concentrations are below 19.5% or above 23.5%. If oxygen concentrations are initially acceptable but the possibility of oxygen content falling below 19.5% or rising above 23.5% exists during work in the confined space, continuous monitoring for oxygen shall also be employed.
3. Continuous monitoring for toxic gases or vapors in the atmosphere shall be employed when they have been found to be present prior to work in the space and when equipment may introduce them during entry.
4. Only approved continuous monitoring equipment shall be employed.

D. Engineering Controls

1. A means of mechanical ventilation that is approved for use in flammable atmospheres will be installed 30 minutes prior to entry to ventilate the space and will be used continuously while the confined space is occupied.
2. If the ventilation system malfunctions, all workers must immediately leave the confined space.
3. All electrical tools and/or lighting devices used in the confined space will be intrinsically safe (e.g. explosion-proof) and either be low voltage (12 volts) or connected to a UL-listed ground fault circuit interrupter (GFCI) device.

E. Personal Protective Equipment

1. Respiratory Protection
   a) Where the oxygen concentration is less than 19.5%, entry will not be permitted except where a self-contained breathing apparatus (SCBA) or airline respirator with escape provisions is used.
   b) Entry into a confined space with concentrations of toxic substances exceeding those limits prescribes by OSHA requires the use of respiratory protection. In most cases, this will necessitate the use of supplied air respirators (SAR) or airline respirator, or, in the worst case, a pressure-demand, open circuit self-contained breathing apparatus or positive-pressure airline respirator with escape provisions. Where the concentration of the toxic material is suspected to be low enough to permit respiratory protection with lower protection factors, EHS must be consulted to approve the use of such respirators in each specific case.
   c) Entry into an atmosphere where there exists the potential for explosion and/or fire (concentrations of flammable gases exceeding 10% LFL) will be attempted only by persons equipped with self-contained breathing apparatus only in case of emergency. These persons shall not enter until after all possible precautions have been taken to minimize ignition sources. Firefighting equipment must be immediately available.
   d) All use of respiratory protection shall be in strict accordance with EHS's Respiratory Protection Program.

2. Harnesses & Retrieval Lines
   a) Retrieval lines/lifelines and full body harnesses will be used by all workers working in Permit-Required Confined Spaces. In spaces greater than 5 feet deep, a mechanical retrieval device (e.g., tripod & hoist) must be utilized.

3. Head Protection
   a) Approved hard hats will be worn when entering all confined spaces. Confined spaces which contain ACM or suspected ACM will only be entered by trained Level II workers wearing Tyvek® (or equivalent) suits and Powered Air Purifying Respirators (PAPRs). (See Step I - Asbestos Containing Materials in this Appendix.)

F. Training

1. All persons working in Permit-Required Confined Spaces shall be trained by FM supervisory personnel for work in that particular type of confined space by use of practice drills.
2. Work to be performed in the confined space is to be reviewed and practiced outside the space before entry may occur. Included in this review will be practice in all non-verbal communication (hand signals) to be used inside the space as well as review of rescue procedures to be implemented in case of emergency.
3. A written record of confined space training must be on file for each employee who enters into a confined space, attends an occupied confined space, or supervises workers who enter or function as attendants in confined spaces.

1. All persons working in Permit-Required Confined Spaces shall be trained by FM supervisory personnel for work in that particular type of confined space by use of practice drills.
2. Work to be performed in the confined space is to be reviewed and practiced outside the space before entry may occur. Included in this review will be practice in all non-verbal communication (hand signals) to be used inside the space as well as review of rescue procedures to be implemented in case of emergency.
3. A written record of confined space training must be on file for each employee who enters into a confined space, attends an occupied confined space, or supervises workers who enter or function as attendants in confined spaces.

G. Labeling and Posting

1. All temporarily open Permit-Required Confined Spaces must be clearly barricaded to exclude all unauthorized personnel. Attached to the barricade must be signs, clearly visible, which read the following:

DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER
TU DEPARTMENT OF FACILITIES MANAGEMENT
(410) 704-2481

H. Rescue and Emergency Procedures

1. All employees entering Permit-Required Confined Spaces shall be equipped with a body harness and with lifeline. Wristlets may be used if appropriate. In spaces greater than 5 feet deep, a mechanical retrieval device (i.e., tripod & hoist) must be used.

2. For all work in Permit-Required Confined Spaces, an attendant must remain outside the space at all times for rescue purposes.
   a) A designated attendant with a means of emergency communication will be present at all times when workers are in the confined space.
   b) This person shall maintain constant contact (visual, or verbal, etc.) with persons working inside the space and must not leave the site even momentarily.
   c) They must keep unauthorized entrants out of the Permit-Required Confined Space.
   d) They must notify entrants of any changes in entry conditions which may create a new hazard, or which require the entrants to leave the space.
   e) If the attendant must leave, even momentarily, all workers must leave the confined space.

3. Emergency procedures including rescue and evacuation should be considered at the same time that work in Permit-Required Confined Space is planned and should be reviewed prior to entry.

4. A means of emergency communication must be immediately available to the attendant and the attendant will be trained in how to summon emergency assistance.

5. In the event of any potentially life-threatening emergency in a Class A or Class B confined space, dial 911. At the emergency blue-light and yellow phones located around campus, press the emergency button to be connected to the TUPD who can contact 911 for you, or dial 911 on the keypad to be connected directly to the 911 Center. Give the dispatcher all of the requested information. The Baltimore County Fire Department is the primary rescue team for all Permit-Required Confined Spaces on campus. TUPD will immediately notify EHS of any confined space emergencies (the 911 Center will notify the TUPD).

I. Asbestos Containing Materials

1. No areas with “damaged" (< 10% localized or < 25% total area) or "significantly damaged" (>10% localized or >25% total area) asbestos containing materials (ACM), other than steam manholes/tunnels, shall be ventilated until the damaged ACM is abated (removed or repaired).
2. For steam manholes where the ACM is either "damaged" or "significantly damaged", a barricade shall be erected at least 15 feet away in all directions around the manhole and/or other openings to prevent accidental entry by non-Level II personnel.
3. Appropriate personal protective equipment must be worn within the barricaded work area as specified in the State of Maryland Asbestos Safety and Health Program Policy & Procedures Manual (ASHPPM) until such time as the ACM is either removed and/or repaired. Copies of the ASHPPM are available for review in EHS.
4. If other toxic contaminants/substances are present in the damaged ACM-containing workspace above allowable concentrations, supplied air respirators must be worn.

J. Other Requirements

1. Despite the assumption that a Permit-Required Confined Space is hazardous because ventilation cannot correct the hazardous condition, every attempt to reduce the hazard by mechanical ventilation must be made. In this way, concentrations of explosive or toxic materials may be reduced to their lowest feasible level prior to entry. Entry into confined spaces with flammable gas or vapor concentrations in excess of 25% of the LFL is prohibited, except by trained and experienced emergency response personnel.

Appendix B: Sample Hot Works Permit

TOWSON UNIVERSITY

Hot Works Permit

EHS PERMIT #:_____

Section 1:

Project Start Date:_____/_____/_____ **Estimated Completion Date:_____/_____/_____**

Start Time:_____AM____ PM____ **Stop Time:_____AM____ PM____**

Building:_____ **Room #/Floor:_____**

Work To Be Accomplished:_____

Section 2:

I certify that I will personally inspect the job site daily to ensure that Items 1 through 6 below has been completed and that arrangements for Item 7 has been made. I will immediately contact TU's Environmental Health & Safety at (410) 704-2949 of any unsafe job site work conditions.

Signed:_____Project Manager/Job Foreman **Date:_____**

Section 3:

DO NOT CUT, WELD, SOLDER, GRIND OR USE ANY OTHER FLAME OR SPARK PRODUCING EQUIPMENT UNTIL THE FOLLOWING PRECAUTIONS HAVE BEEN TAKEN.

INITIAL EACH ITEM:

_____1. a. Floors and surrounding areas are swept clear of all combustible materials.

b. Materials that are combustible and can't be moved are covered with a non-combustible fire retardant cover or are thoroughly wetted down with water.

c. All wall or floor openings and other holes within 35 feet are tightly covered. Covers are suspended beneath overhead work to catch sparks, hot slag, etc.

d. A responsible fire watch has been assigned to watch for sparks & fires in the work area as well as on the floors above and below.

_____2. A serviceable dry chemical fire extinguisher is on site, immediately accessible, and employees are trained with its use and limitations. Employees are trained with procedures for sounding TU fire alarm.

_____3. All flame or spark producing equipment has been inspected and is in good repair.

_____4. The fire sprinkler system, where present, is in service and fully operational.

_____5. Appropriate arrangements have been made with TU's EH&S to prevent the accidental initiation of fire detection and alarm systems.

_____6. There are no flammable liquids, vapors, dusts, lints or equipment previously containing such materials in the work area.

_____7. A responsible fire watch will remain at the job site for minimum 60 minutes after the completion of any hot work to ensure no smoldering fires are present.

IN CASE OF FIRE OR EMERGENCY – IMMEDIATELY CALL 911

Section 4:

Approved:_____Date:_____

TU Environmental Health & Safety

Section 5:

Permit Closeout

Job Completed at_____AM/PM on ____/____/_____. Signed:_____

(Time) (Date) (Project Manager/Job Foreman)

TOP COPY – Display at Job Site & Return to EHS upon Job Completion **BOTTOM COPY – EHS**

03/19

Appendix C: Sample Confined Space Entry Permit

TOWSON UNIVERSITY	Occupational Safety Program **Confined Space Entry Program** Form	**Confined Space Entry Permit**	Revision 0.0 Prepared by: **FHB** 8/28/2024

Permit to be completed by Entry Supervisor. Must post at entry. Valid during authorized period, 8 hr max. After 8 hr, a new permit is required.

General Information	**Authorized Duration Period**	
Confined Space ID/Type:	Start Date & Time	End Date & Time
Location:		
Task/Purpose of Entry:		

Entry Personnel (List by Name or Attach Roster)	
Authorized Entrants	Authorized Attendants

Hazards & Controls	**In Case of Emergency/Fire - 911; TUPD - 410-704-4444**
Hazard (✔) Present: □ O_2 < 19.5% □ O_2 > 23.5% □ > 10% LFL □ Heat □ Airborne Combustible Dust (≥ LFL) □ Electrical □ Mechanical □ Engulfment □ Entrapment □ Corrosive □ Toxic □ Other, Specify: _____	**Safety Equipment Required for Entry & Work** PPE:
Entry Preparation (✔as completed): □ Notify Affected Areas Isolation: □ LOTO □ Blank/Blind □ Purge/Clean □ Inert □ Atmospheric Test □ Barriers □ Ventilate □ Other	Respiratory Protection: □ N/A (No Air Hazards) □ SAR/Airline □ SCBA (Either Must Use Full-Face) Atmospheric Monitoring Device (Mfr., Model No.):
Personnel: □ Notify of Pre-Entry Hazards & Control Methods □ Notify Contractors of Permits, Hazards, & Controls	Communication: □ Radio □ Vocal □ Other Rescue/Retrieval: □ Body Harness/D-Ring □ Davit □ Anchor/Tripod □ Winch □ Wristlet
Add'l Permits (Must Attach): □ Hot Works □ Other	Lighting, Explosion-Proof: □ Built-In □ Portable
□ Communication Procedures. Explain:	Ventilation: □ Natural □ Mechanical (Forced Air)
□ Rescue Procedures. Explain:	Barrier To Entry: □ A-Frame/Portable Barricade □ Fence/Gate □ Tape □ Other _____ Other: □ Alarm System □ EW/SS □ Fire Extinguisher

Testing Record	Atmospheric Monitoring Conditions - Acceptable Range for Initial and Continuous Entry								
	O_2 (19.5-23.5%)	Flammability (< 10% LFL)	H_2S (< 10 ppm)	CO (< 35 ppm)	SO_2 (< 2 ppm)	Cl_2 (< 0.5 ppm)	Other ( ) ( )	Temp. (°F)/ RH%	Tester Initials
Time (AM/PM)	Results (Attach Additional Results Sheet As Necessary)								
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Authorization - Entry Supervisor	I certify that all required precautions have been taken and necessary equipment is provided for safe entry and work in this confined space.		
Name (Please Print)	**Signature**	**Date**	**Time**

Appendix D: Confined Space Standards & Regulations

29 CFR 1910.146: Permit-Required Confined Spaces
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.146

29 CFR 1926.1200 - 29 CFR 1926.1213: Confined Spaces in Construction
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1200
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1201
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1202
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1203
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1204
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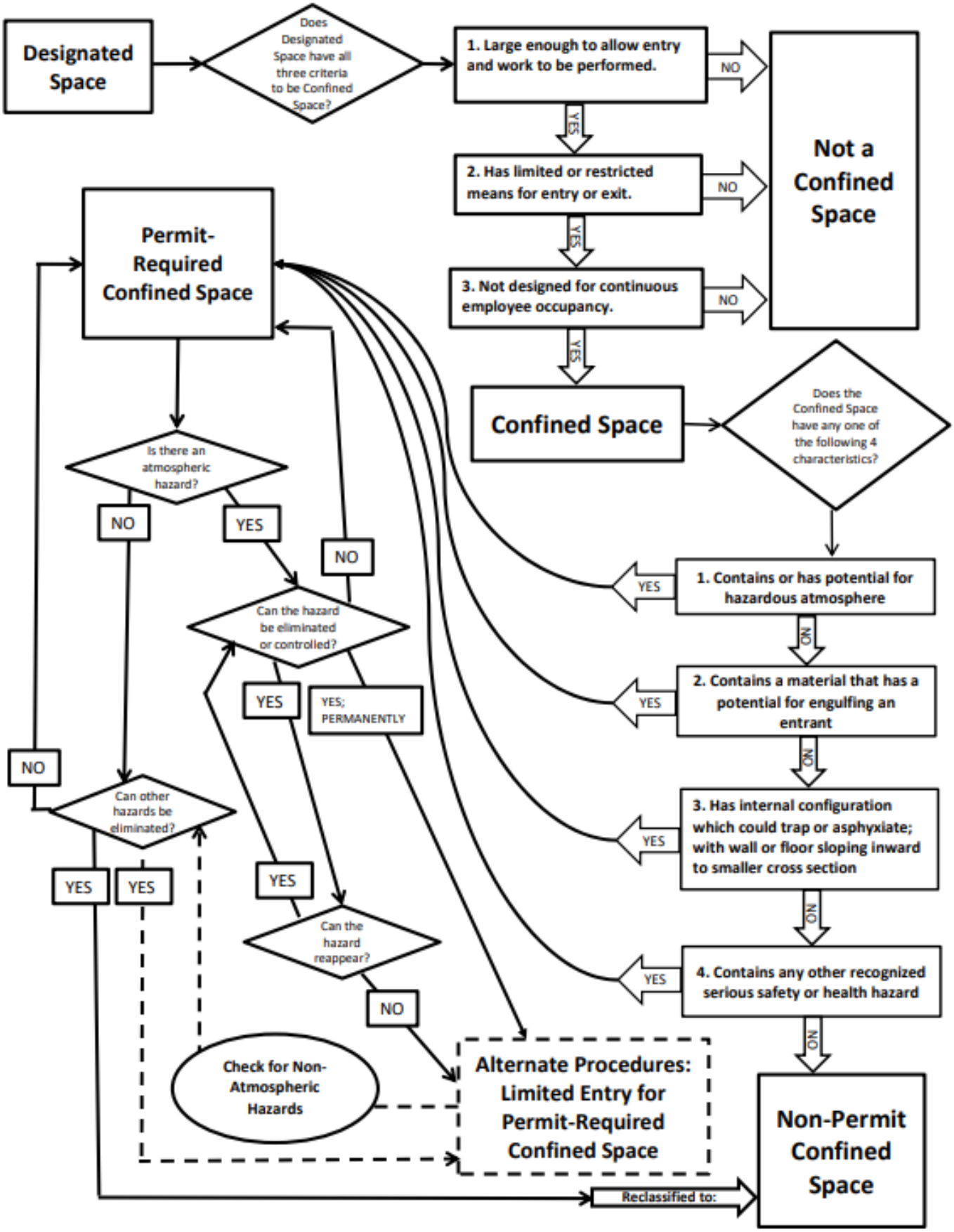
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1211
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1212
https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1213

ANSI Z117.1-2009: Safety Requirements for Confined Spaces
https://media.msanet.com/na/usa/fallprotection/rescueproducts/workmantripod/ANSIZ117.1-2009WhitePaper.pdf

Appendix E: Permit-Required Confined Space Decision Flow Chart



Appendix F: Steam Tunnel Entry Procedures

A. Alternate Plan for Entry into Steam Tunnels

The following alternate plan developed by EHS is being included to illustrate how Towson University is addressing the steam distribution tunnel system. Departments with similar situations may be able to use this as a guide to develop alternate procedures for their areas.

Alternate procedures must include justification for the plan, entry procedures, emergency procedures, and monitoring and inspection data to support their use. EHS will assist with the development of alternate procedures as necessary.

Justification: The Towson University steam distribution tunnel system presents a unique situation in regards to confined space entry procedures and compliance with 29 CFR 1910.146.

The steam tunnel system falls within a regulatory gray area. It is difficult to define the entire system as a confined space; and it is equally difficult to identify specific areas or passages as confined spaces. Furthermore, and more importantly, normal confined space entry procedures are both impractical and do little to protect the health and safety of employees entering the steam tunnel system.

Significant factors that were identified and evaluated in the development of this alternate plan include:

1. The steam tunnel system is a controlled access work area. Authorization is required to enter the steam tunnel system. Specific steam tunnel entry procedures have been developed and implemented.
2. A considerable portion of the main tunnel system is designed for employees to enter through building equipment room doors, walk through the tunnel passages, and perform equipment maintenance.
3. Two means of egress (through doors or manholes) exist in the main tunnel system except for blind ends.
4. Identifying areas within the tunnels that truly meet the criteria of a confined space as defined in 29 CFR 1910.146(b) would be difficult and confusing.
5. There is little possibility for a hazardous atmosphere as defined in 29 CFR 1910.146(b) to develop under normal operating conditions.
6. Although means of egress are restricted or limited, entrapment hazards as defined in 29 CFR 1910.146(b) do not exist in the main steam tunnel system.
7. Under normal operating conditions, engulfment hazards as defined in 29 CFR 1910.146(b) do not exist in the steam tunnel system.
8. Other serious hazards (exposed electrical conductors, moving machinery or lines that discharge hazardous materials in the space) as defined in 29 CFR 1910.146(b) do not exist in the main steam tunnel system under normal operating conditions.

9. Normal confined space entry procedures (the use of an attendant, retrieval equipment and air monitoring devices) are not practical and do not protect employees, in fact, they may hinder self-rescue, from the most significant potential hazard, a steam line rupture.
10. The use of the buddy system and requiring all entrants to carry two-way radios is a more effective method to protect employee health and safety.

After carefully considering all factors involved, and soliciting employee input, EHS has adopted the following alternate plan to protect the health and safety of employees entering the steam distribution tunnel system.

B. Pre-Planning for Work in Steam Tunnels

1. The Chief Engineer of the Power Plant shall be notified prior to the entry of any individual into the steam tunnel system.
2. The Chief Engineer of the Power Plant shall be included in the work pre-planning of non-Power Plant employees.
3. EHS shall be notified prior to the entry of any individual into the steam tunnel system.
4. EHS shall be included in the work pre-planning of all employees entering the tunnel system.
5. Prior to entering steam tunnels, the supervisor and workers shall discuss the scope and sequence of the work.
6. Pre-planning shall include a discussion of all potential hazards, means and methods of hazard control, and emergency pre-plans:
   a) Identities and locations of energized steam lines
   b) Identities and locations of energized compressed air lines
   c) Identities and locations of energized high-voltage electrical conductors
   d) Identities and known locations of asbestos-containing, thermal insulting material (TSI) such as pipe fittings or insulation.
   e) Locations of exposed hot surfaces
   f) Signs and symptoms of heat exhaustion and heat stroke
   g) Lighting
   h) Means of communication
   i) Means of entry and egress
   j) Hazards created by work activity (chemical products and welding/cutting)
   k) External hazards (work in roadways, walkways)
   l) Identities of any job-site specific hazards
   m) Means to control hazards (personal protective equipment, ventilation/local exhaust, lockout/tagout)
   n) Steam line de-energization and lockout procedures
   o) Potential emergency situations and pre-plans
7. The locations of entry and egress from potentially dangerous work conditions will be identified to all personnel working in the tunnel. When deemed appropriate and prudent, multiple accesses shall be opened to provide alternative means of egress.
8. The buddy system will be used by employees entering the steam tunnel system.

9. All employees entering the steam tunnel should be CPR certified and must be confined space certified. For Contractors, the company's specific Confined Space Program and training records will be forwarded to EHS for review.
10. Employees working in the tunnel system shall carry a portable flashlight and two-way radio at all times. Ensure they have direct communication to the outside (i.e. radio to someone on top or cell phone) and ensure the radios receive a signal and operate properly in the tunnel before entry and work begins.
11. Someone shall notify the Towson University Police Department (TUPD) that employees will be working in the tunnel over the weekend in case of an incident - that way the TUPD can be prepared if an emergency arises.
12. Protective leather gloves and hard hats shall be worn when working in steam tunnels.
13. Other items of personal protective equipment, required to control job-specific hazards, shall be identified in job planning and worn by all personnel.
14. Supervisor and workers shall discuss job-specific emergency procedures.
15. Hot work (welding, cutting, brazing) requires authorization by the Fire Safety Manager. When hot work is performed, forced ventilation shall be provided and the atmosphere shall be monitored for flammable gases, oxygen content and carbon monoxide. Standard size welding gas cylinders shall not be taken into steam tunnels.

C. Procedures for Steam Tunnel Emergencies

1. If an acute threat to safety and health is observed or perceived, all personnel shall immediately exit the tunnel by the nearest means of egress.
   a) Assist injured in escape
   b) Do not re-enter tunnel until hazard is identified and evaluated
   c) Secure job site
   d) Contact supervisor

2. If emergency assistance is required, use either the nearest phone to call 911 or contact TUPD (i.e. "Towson") on the two-way radio to summon emergency assistance. Clearly state to the dispatcher that it is an emergency and provide the following information:
   a) Location of the emergency
   b) Phone number from where the call is being made (if phone is used)
   c) Your name
   d) What happened
   e) What assistance is needed
   f) Help or first aid that is being provided

   If a phone is used, let the person you contacted hang up first.

3. Station someone at a highly visible location along the street to flag down and direct the emergency response vehicle to the scene of the emergency.

If required, render appropriate and prudent first aid until EMS personnel arrive on scene.

Appendix G: Stormwater & Underground Stream Diversion Culverts

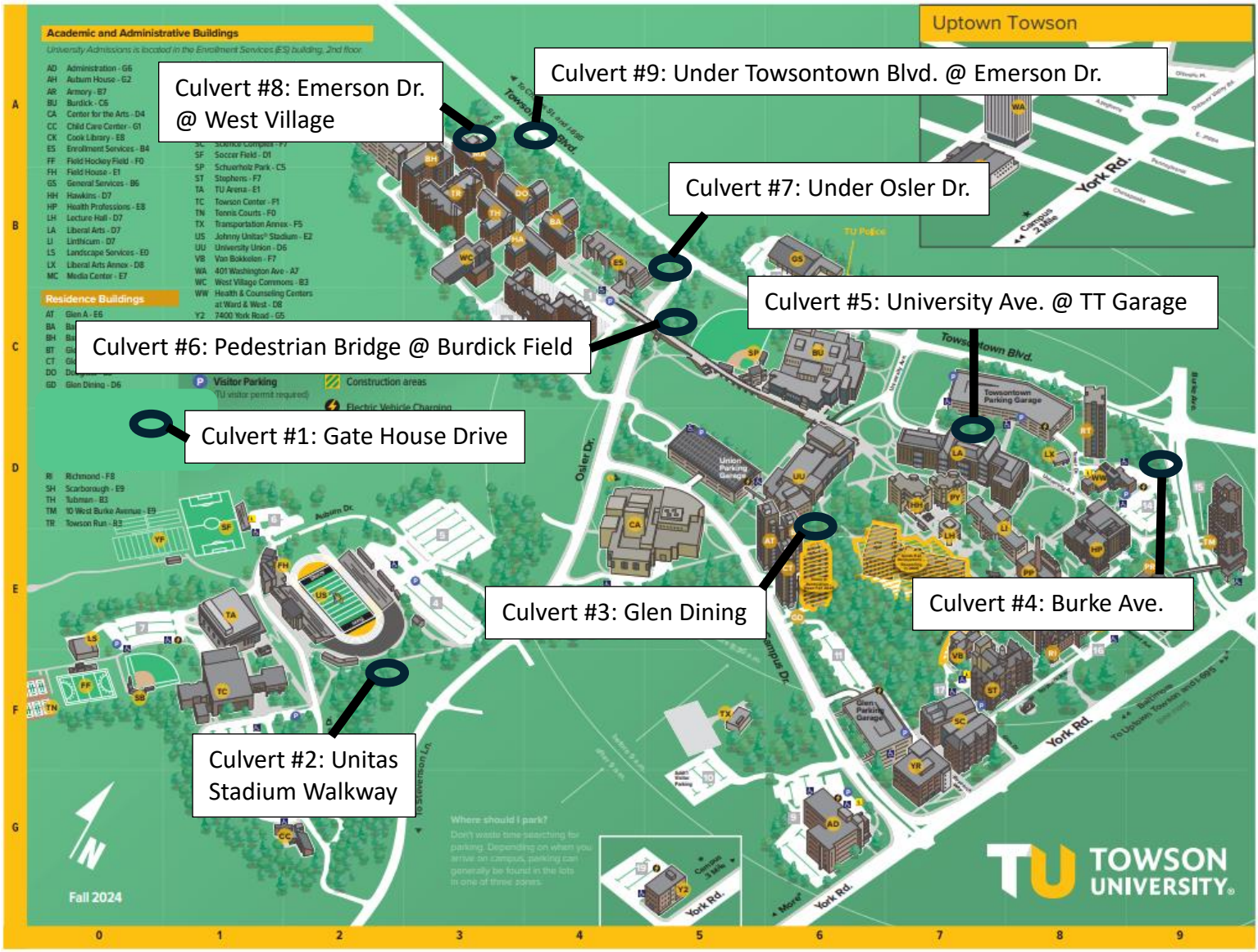


Figure 1. Stormwater & Underground Stream Diversion Culverts Map. The map displays the main campus at Towson University, and includes culverts by number and name, as of 8/8/2024. Black loop marks represent an approximate location for the respective culvert highlighted.

Designation of Location:	What Entering Into	Purpose of Entry	CS	PRCS	Known Hazards Needing Elimination	Potential Hazards	PPE/Type of Retrieval System/Other Hazard Control Equipment	Testing Equipment	Signage Needed;/Isolate to Eliminate Entry
Culvert #1-(Gate House Drive-at Practice Field) (Map Location: C-1)	Storm Water/ Underground stream	Inspection; Clean-out; Repairs	Y	Y	None known	Oxygen deficiency from decay of organic material; (limited natural ventilation); Engulfment from flash flood waters	Communication Device	Confined Space Meter testing; Minimum testing: O_2; LEL; H_2S;	**Danger:** Confined Space with potential for oxygen deficiency and/or engulfment. Do Not Enter without proper safety precautions
Culvert #2-(Unitas Stadium Walkway-East End) (Map Location F-2)	Storm Water/ Underground stream	Inspection; Clean-out; Repairs	Y	Y	None known	Oxygen deficiency from decay of organic material; (limited natural ventilation); Engulfment from flash flood waters	Communication Device	Confined Space Meter testing; Minimum testing: O_2; LEL; H_2S;	**Danger:** Confined Space with potential for oxygen deficiency and/or engulfment. Do Not Enter without proper safety precautions
Culvert #3 - (Glen Dining) (Map Location D-6)	Storm Water/ Underground stream	Inspection; Clean-out; Repairs	Y	Y	None known	High potential for Oxygen deficiency from decay of organic material; (limited natural ventilation); Engulfment from flash flood waters	Communication Device	Confined Space Meter testing; Minimum testing: O_2; LEL; H_2S;	**Danger:** Confined Space with potential for oxygen deficiency and/or engulfment. Do Not Enter without proper safety precautions
Culvert #4 - (Along Burke Ave. Behind Ward/West Health Center) (Map Location D-9)	Storm Water/stream	None	N	N	None Known	Flood waters			**Caution:** Beware of possible flood waters
Culvert #5 - (Along University Ave.- by Towsontown Garage) (Map Location D-7)	Storm Water/ Underground stream	Inspection; Clean-out; Repairs	Y	Y	None known	High potential for Oxygen deficiency from decay of organic material; (limited natural ventilation); Engulfment from flash flood waters	Communication Device	Confined Space Meter testing; Minimum testing: O_2; LEL; H_2S;	**Danger:** Confined Space with potential for oxygen deficiency and/or engulfment. Do Not Enter without proper safety precautions
Culvert #6 - (Pedestrian Bridge at Burdick Field) (Map Location C-6)	Storm Water/ Underground stream	Inspection; Clean-out; Repairs	Y	Y	None known	High potential for Oxygen deficiency from decay of organic material; (limited natural ventilation); Engulfment from flash flood waters	Communication Device	Confined Space Meter testing; Minimum testing: O_2; LEL; H_2S;	**Danger:** Confined Space with potential for oxygen deficiency and/or engulfment. Do Not Enter without proper safety precautions
Culvert #7 - (Under Osler Drive) (Map Location B-6)	Storm Water/stream	None	N	N	None Known	Flood waters			**Caution:** Beware of possible flood waters
Culvert #8 - (Emerson Drive at West Village) (Map Location A-4)	Storm Water/stream	Inspection; Clean-out; Repairs	Y	N	High water level; Debris	Flood waters; entrapment	Stand-by personnel		**Danger:** Confined Space with potential for entrapment. Do Not Enter without proper safety precautions
Culvert #9 - (Under Towsontown Blvd. at Emerson Drive) (Map Location A-5)	Storm Water/stream	Unknown	Y	N	None Known	Flood waters; entrapment	Stand-by personnel		**Danger:** Confined Space with potential for entrapment. Do Not Enter without proper safety precautions

Table 1. Stormwater & Underground Stream Diversion Culverts Data. The table provides map data from Figure 1 in Appendix G. The data includes culverts by number and name, equivalent map location, and respective information on confined space designation, associated hazards, and mitigation techniques.