DUQUESNE UNIVERSITY

CONFINED SPACES PROGRAM

Prepared by: Environmental Health and Safety Department

TABLE OF CONTENTS

PURPOSE

The purpose of this Confined Spaces Program is to ensure the requirements for safe practices and procedures are followed to protect Duquesne University employees and contractors from the hazards of entry into confined spaces. This Confined Spaces Program was developed to comply with OSHA's Permit-Required Confined Spaces Standard (29 CFR 1910.146) and prevent unnecessary injuries or the loss of life. The standard requires that all confined spaces be identified and that a written program be generated to outline procedures required for entry into those spaces. This program is designed to ensure that safe work practices are utilized during all activities regarding the permit space to prevent personal injuries and illnesses that could occur.

SCOPE

This program is applicable to all University students, faculty, staff and contractors/sub-contractors that are required, by the nature of their job, to enter vessels or enclosures that are considered confined spaces under the definitions listed in Appendix A.

PROGRAM RESPONSIBILITIES AND DUTIES

A. University Administration - It is understood that the Duquesne University Administration has the ultimate responsibility for this Confined Spaces Program. The Administration of Duquesne University also assumes the responsibility for ensuring compliance with the OSHA Standard 29 CFR 1910.146.

B. Director, Environmental Health and Safety (EHS) - Is designated as the Confined Spaces Program Coordinator and will review and update the program as necessary. Copies of the written program may be obtained from the EHS Department. The EHS Department is also responsible for identifying and posting proper signage for confined spaces throughout campus and providing proper training to pertinent employees and/or contractors before entering and/or performing work within confined spaces.

C. University Departments - Each university department, who has employees and/or contractors that may be required to enter confined spaces, adopt and implement Duquesne University's Confined Spaces Program. These employees and/or contractors must have the proper training prior to entering confined spaces.

D. Managers and Supervisors - Are responsible for:
    a. Determining whether employees need to enter confined spaces.
    b. Identifying employees who will be required to participate in confined space entries as part of their duties.
    c. Ensuring that all employees required to participate in confined spaces are properly trained prior to assignment.
    d. Ensuring that proper safety equipment required for entry is made available and in working condition to employees.
    e. Ensuring that all provisions of this Confined Spaces Program are followed.

E. Employees - Are responsible for observing all safe practices and procedures contained in this Confined Spaces Program, for other general safety practices, for attending designated training sessions, and for reporting hazardous or unsafe conditions to their supervisor, the entry supervisor, and/or the EHS Department. Those designated as authorized entrants, entry supervisors, and attendants are responsible for additional duties as follows:
    a. Authorized Entrants
        i. Know the hazards, including the mode, signs or symptoms, and the consequences of exposure that may be faced during entry.
        ii. Proper use of the equipment required for confined space entry.
        iii. Communicating with the attendant regarding air monitoring status and the need to evacuate the space.
        iv. For alerting the attendant when any warning signs or symptoms of exposure to a hazardous situation or a prohibited condition arises.
        v. For exiting the confined space as quickly as possible whenever an evacuation is given by the attendant or entry supervisor.
        vi. For exiting a confined space when a hazardous situation develops or a prohibited condition arises.
    b. Attendants
        i. Know the hazards, including the mode, signs or symptoms, and the consequences of exposure that may be faced during entry.
        ii. Is aware of possible behavioral effects of hazardous exposures in authorized entrants.
        iii. Maintains an accurate count of the authorized entrants within the permit space.
        iv. Remains outside the permit space during entry procedures until relieved by another attendant. At no time will the attendant enter the confined space for rescue operations.

v. Communicating with authorized entrants regarding air monitoring status and the need to evacuate the space.
vi. Monitors activities inside and outside the permit space to determine if it's safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space under any of the following conditions:
    1. If a prohibited condition is detected.
    2. If behavioral effects of hazard exposure is detected in an authorized entrant.
    3. If the attendant detects a situation outside the space that may endanger the authorized entrants.
    4. If the attendant can not effectively and safely perform all the duties required.
vii. Summons rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from the permit space.
viii. Warns unauthorized persons that they must stay away from the permit space and advises them to exit immediately if they have entered the permit space.
ix. Informs the authorized entrants and entry supervisor if unauthorized persons have entered the permit space.
x. May help with rescue procedures without entering the permit space.
xi. Perform no other duty that may interfere with the primary duties to monitor and protect the authorized entrants.

c. Entry Supervisors
    i. Know the hazards, including the mode, signs or symptoms, and the consequences of exposure that may be faced during entry.
    ii. Verifies that all tests and all equipment specified by the permit have been conducted and is available prior to endorsing and allowing entry to begin.
    iii. Terminates and cancels the permit when entry operations have been completed or when a prohibited condition in or near the permit space arises.
    iv. Removes unauthorized persons who enter or attempt to enter a permit space during entry operations.
    v. Ensures that entry operations remain consistent with the terms of the entry permit and that acceptable entry conditions are maintained.

TRAINING REQUIREMENTS

Duquesne University will provide training to all employees under the direct authority of Duquesne University whose work involves confined space entry. Each training session will cover this Confined Spaces Program and all the necessary requirements set forth in the OSHA Standard 29 CFR 1910.146 to ensure each person regulated by this standard has the understanding, knowledge, and skills necessary for the safe performance of his/her duties.

Each University department is responsible for assuring each individual who performs work within confined spaces is properly trained according to this program and the OSHA regulations. Each University department utilizing contractors/sub-contractors for confined space entry work is responsible for ensuring each outside employee has been properly certified for confined space entry prior to entering any confined spaces on Duquesne University premises. Duquesne University will not certify outside contractors/sub-contractor for confined space entry training. Duquesne University will only provide site-specific training prior to entry.

Training and/or retraining will be provided (through the EHS Department) to each affected person according to the following:

1. Before the person is first assigned duties under this program.
2. Before there is a change in assigned duties.

3. Whenever there is a change in the permit space operations that presents a hazard about which personnel have not been previously trained on.
4. Whenever Duquesne University has reason to believe there are deviations from the permit space entry procedures or there are inadequacies in the personnel's knowledge or use of these procedures.
5. Training will establish personnel proficiency in his/her duties and will introduce new or revised procedures to this program.
6. Each training session will be certified with the attendee's name and signature, the trainer's name and the date of the training. This certification will be available to all attendees and/or their authorized representatives and will be kept on file for a minimum of three years from the date of the training.

IDENTIFICATION OF CONFINED SPACES

All grounds and facilities at Duquesne University will be evaluated for the presence of confined spaces. Each confined space will be classified as non-permit required or permit required confined spaces corresponding to the type of confined space defined by the OSHA standard. The EHS Department will be responsible for the classification of each confined space and maintaining the master list of all confined space at Duquesne University.

Permit required confined spaces may be downgraded and classified according to the guidelines in the Reclassifying a Confined Space section of this program. Introducing new hazards within a confined space may change its classification.

PREVENTION OF UNAUTHORIZED ENTRY

Duquesne University will take all precautions to help prevent unauthorized entry into confined spaces. The primary means for preventing unauthorized entry will be through signage and training, but locks, barriers/barricades, and/or banner tape may also be utilized to identify and isolate confined space areas. Attendants and Entry Supervisors are responsible for preventing unauthorized entry into confined spaces as well.

ATMOSPHERE TESTING

Testing the confined space atmosphere is essential for the evaluation of hazards and the verification that acceptable entry conditions within the confined space exist. The confined space must be tested for oxygen content, flammable gases and vapors, and toxic air contaminants, in this order. All atmospheric testing must be recorded on the Entry Permit.

Testing for atmospheric hazards will be conducted prior to entry into a permit required confined space. This pre-entry testing will be performed in such a way without entering the confined space. The atmosphere within the confined space will be tested at three different levels (bottom, middle and top). Once acceptable entry conditions are verified, atmospheric testing will be continuous during entry and these results (and the time) will be recorded on the Entry Permit every hour. If at any time the monitoring instrument sounds an alarm or fails to operate properly, entry must stop and all entrants will leave the space immediately.

Direct reading monitoring equipment is required to conduct atmospheric testing. The instrument must be calibrated and in good working condition prior to use. Monitoring equipment will be maintained according to the manufacturer's specifications to ensure proper operation during atmospheric testing and entry.

PERMIT SYSTEM

An Entry Permit is required to document compliance that all safety prerequisites have been completed, to verify hazards have been controlled and to record the results of atmospheric testing for permit required confined space entry. Entry Permits must contain the following information:

1. Space to be entered.
2. Purpose of entry.
3. Date and duration of entry.
4. Authorized Entrants (by name).
5. Attendant names.
6. Entry supervisor (with signature authorizing entry).
7. Hazards of the permit space to be entered.
8. Measures to isolate the space or to eliminate or control space hazards, including lockout/tagout, ventilation, blanking of lines, etc.
9. Acceptable entry conditions.
10. Results of initial and periodic atmosphere monitoring, including names of those doing monitoring.
11. Rescue and emergency procedures to be used.
12. Communication procedures used by Authorized Entrants and Attendants.
13. Required equipment, including PPE, monitors/alarms, rescue items and any other required safety equipment.
14. Additional safety information needed to safely complete the entry.
15. Additional permits, such as those for hot work that has been permitted for the space.

The permit system is beneficial only if the Entry Permit is properly completed. Entry Permits must be:

1. Signed by the Entry Supervisor authorizing entry.
2. Available to entrants prior to and during entry.
3. Only authorized for the duration of the required task.
4. Kept for at least 1 year for program review purposes. Any problems encountered must be noted on the permit so appropriate revisions to the permit space program can be made.
5. Terminated and/or canceled, by the Entry Supervisor when:
    a. The pre-entry operations have not been completed or discussed with entrants.
    b. Conditions arise that prevent entry.
    c. Conditions outlined in the permit change.
    d. Conditions not allowed under the entry permit arise in or near the permit space.
    e. The projected work has been completed.
6. Must be posted or available at the confined space entrance. Departments must develop a system for issuing and filing Entry Permits. All closed/canceled Entry Permits are to be returned to the EHS department for proper record keeping for a period of three years after the date the Entry Permit has expired.

CONFINED SPACE ENTRY

Non-Permit Required - confined spaces do not have, or with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm. Non-permit required confined spaces do not require specific controls for entry unless being downgraded from a permit required confined space. Requirements for downgrading confined spaces can be found in the Reclassifying a Confined Space section of this program.

At no time, while working within a non-permit required confined space, may a new hazard be introduced so that the confined space can no longer be classified as a non-permit required confined space. This may include but not limited to the use of paints, solvents, toxic chemicals or welding equipment.

Permit Required - confined spaces are characterized by meeting the definition of a confined space as well as having one or more of the following hazards:

1. Contains or has the 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.
4. Contains any other recognized serious safety or health hazard.

Permit required confined space entry procedures shall be observed when all serious hazards (hazardous atmosphere, engulfment, entrapment or other recognizable serious hazards) cannot be eliminated prior to entry into the confined space. Permit required confined spaces require an entrant, attendant, and an entry supervisor. A rescue team is also required to be available at the entry space during the entire time entry is made. The entry supervisor authorizes the entry and ensures all necessary requirements are met prior to and during entry into a permit required confined space. The attendant is stationed outside one or more adjacent permit required spaces and monitors the entrants and performs all necessary duties described below.

The hazards in a permit required confined space must be identified, evaluated, and controlled prior to entry. All appropriate PPE must be worn during entry to protect the worker from any potential hazards. The hazards, controls and required PPE must be recorded on the Entry Permit.

General requirements for a permit required confined space entry are as follows:

1. Entry must be accomplished utilizing a properly filled-out Entry Permit.
2. The completed Entry Permit must be present at the work site during a permit required confined space entry.
3. A properly trained entry supervisor must authorize entry.
4. Any hot work to be performed must be authorized on the Entry Permit and a separate Hot Work Permit authorized.
5. Identify all potential hazards:
    a. Inherent to the confined space (toxic gases, explosive/flammable gases/vapors, oxygen deficiency, engulfment materials, space configuration, pressure systems, electrical equipment, chemicals, mechanical equipment, etc.)
    b. Created by the work to be performed within the confined space (welding, cutting, chemical/solvent use, grinding, etc.)
    c. Chemicals to be utilized within the confined space (gases, corrosives, etc,)
    d. Any other safety hazards (slip/trip/fall hazards, lighting, low ceilings, strike against, struck by hazards, etc.)
6. Identify the means and methods to control or eliminate the hazards through:
    a. Engineering controls, ventilation, isolation of the space, and lockout/tagout procedures.
    b. Modification of work practices.
    c. Proper selection and use of personal protective equipment (PPE).
7. Identify the procedures and action in the event of an emergency situation.

General Requirements Prior to Entry

The following general requirements are necessary prior to entry in a permit required confined space:

1. The entry supervisor will ensure that all hazards are controlled within the permit required confined space prior to entry.
2. The entry supervisor will ensure the Entry Permit is properly filled out which includes identifying all authorized entrants and attendants.
3. A pre-entry briefing by the entry supervisor is required prior to entering any permit required confined space. All personnel involved in a permit required confined space entry must attend this briefing including all authorized entrants, attendants, and entry supervisor. The rescue team must be brief as to the nature and location of the entry and be in communication with the authorized attendant.
4. Any condition(s) making it unsafe to remove an entrance cover must be eliminated prior to removing the cover.
5. Once entrance covers are removed, the opening will be promptly guarded by railing, temporary cover, or any other temporary barrier that will prevent an accidental fall through the opening and that will provide protection for each person within the space from falling objects entering the space.
6. Retrieval equipment must be in place. If the space is greater than a five (5) foot vertical drop, a tripod type retrieval system must be utilized.
7. The confined space must be ventilated for the required amount of time according to the Ventilation section of this program.
8. The authorized attendant must be stationed outside the entrance.
9. Prior to a worker entering the space, the internal atmosphere must be tested for oxygen content, flammable gases or vapors, and for potential toxic air contaminants, in that order. Various levels and areas of the permit required confined space must be tested for accurate readings.
10. The confined space must contain acceptable conditions, as on the Entry Permit, prior to entry. If these conditions can not be met, forced air ventilation will continue until acceptable entry conditions are met. If acceptable entry conditions can not be met, appropriate PPE must be worn.
11. The person making the initial survey will sign the Entry Permit.
12. The initial test results will be provided to authorized entrants for review.
13. The entry supervisor will authorize entry by signing and dating the Entry Permit.
14. The entrance to the confined space must be isolated and identified by using barricades, signage and/or banner tape.
15. Secure and isolate the permit required confined space.
16. Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards.
17. Contact Public Safety and inform dispatcher which permit-required confined space will be entered.

<u>General Requirements during Entry</u>

The following general requirements are necessary during entry within a permit required confined space:

1. The maximum time during entry into a permit required confined space is eight (8) hours. If work is not completed within the eight-hour period, a new Entry Log must be issued.
2. Continuous forced air ventilation must be used at all times the space is occupied in accordance with the Ventilation section of this program.
3. The atmosphere within the permit required confined space must be tested and recorded (on the Entry Permit) every hour to ensure that the forced air ventilation is preventing the accumulation of a hazardous atmosphere.
4. If a hazardous atmosphere is detected during entry, all personnel will evacuate the space immediately. The EHS Department must be contacted and an investigation will be conducted to determine how the hazardous atmosphere developed. Personnel will not be allowed access to the space until the hazard is eliminated.

5. The attendant will be stationed at the entrance the entire time of entry and will maintain contact with the entrants. The attendant may leave only if replaced by another authorized attendant with the knowledge of the entry supervisor.
6. All entrants must wear a full-body harness attached to a retrieval line unless such equipment creates a hazard or inhibits self-rescue.
7. Upon completion of the work within the space, the space will be cleared of personnel, equipment, tools, etc and the entrance replaced in its original position/condition. The Entry Permit(s) will be filed with the Safety Manager, Facilities Management upon completion.

Note: Definitions are located in Appendix A of this Confined Spaces Program.

Note: Utility Tunnel Entry procedures are located in Appendix B of this Confined Spaces Program and are not considered Permit-Required Confined Spaces.

Note: Boiler and Pressure Vessel Entry procedures are located in Appendix C of this Confined Spaces Program and are considered Permit-Required Confined Spaces.

REQUIRED EQUIPMENT

A variety of safety equipment is required to assist safe entries into and rescue from confined spaces. This equipment must be supplied to employees engaged in confined space entry at no charge to the employee. The extent of actual equipment required will depend on the hazards present and the confined space to be entered. All employees utilizing the required safety equipment will be properly trained in the use of that equipment. The following safety equipment is required for the safe entry into permit required confined spaces:

1. Atmosphere testing equipment (obtain from the Energy Center Control Room or Facilities Stores)
2. Ventilation equipment to obtain and maintain acceptable entry conditions.
3. Equipment for communicating between attendant, entrants and the University's Public Safety Department.
4. All necessary PPE including retrieval equipment, full body harnesses, and lanyards.
5. Lighting equipment so entrants are able to work safely.
6. Lockout/Tagout devices (if necessary).
7. Barriers and shields.
8. Any necessary equipment needed for safe entry and egress.

VENTILATION

According to this Confined Spaces Program, numerous confined spaces may require forced air ventilation prior to entry and/or ventilated continuously while entry operations are in progress. The following requirements apply to forced air ventilation:

1. Entry into the confined space will not occur until the space has been eliminated of any hazardous atmosphere.
2. Forced air ventilation will be directed as to ventilate the immediate areas where an entrant is or will be present within the space and will run continuously until all entrants have left the space.
3. The air supply will be from a clean source and may not increase the hazards in the space.
4. The atmosphere within the space will be tested continuously to ensure that the forced air ventilation is preventing the accumulation of a hazardous atmosphere.

If ventilation is required prior to entry into a permit required confined space, the space will be ventilated for at least 15 minutes if it is ≤2500 ft^3, 25 minutes if the space is between 2500 ft^3 and 4500 ft^3, and 30 minutes if the space is between 4500 ft^3 and 6000 ft^3. This is assuming using the Allegro Industries axial blower (Model 9514)

with free airflow of 1390 cfm. If using a 90◦ bend, the airflow decreases to 736 cfm. A space ≤2500 ft^3 would then be require to be ventilated for 25 minutes, 45 minutes if the space is between 2500 ft^3 and 4500 ft^3, and 60 minutes if the space is between 4500 ft^3 and 6000 ft^3. Please refer to the Allegro Industries axial blower (Model 9514) operating manual for further instructions.

EMERGENCY RESPONSE AND RESCUE

Duquesne University will rely on outside rescue personnel in the event of an emergency during a permit required confined space entry. The University's Public Safety Department will assist in crowd and traffic control during an emergency situation. Public Safety should be notified by utilizing two-way radio communication, by campus telephone by dialing x2677, or via a cell phone by dialing 412-396-2677. Public Safety will then notify the pertinent emergency response personnel and the need for immediate rescue. Public Safety will be contacted if the following type of rescue is required:

1. Self-rescue (if serious injury is involved).
2. Attendant non-entry rescue.
3. Emergency response personnel.

Once at the scene, the emergency response team will take control until the victim has exited the space.

Self-Rescue

The best rescue option is a self-rescue in which the entrant recognizes the signs/symptoms of exposure or is injured and immediately exits the confined space without the aid of the attendant or rescue equipment. If any threat to safety/health is observed or perceived, all personnel will:

1. Assist any injured person and exit the confined space immediately.
2. Secure the job site.
3. Contact supervisor/manager of the project.
4. Once outside the confined space, remain outside until the hazard is identified, evaluated, and eliminated. DO NOT RE-ENTER THE SPACE.

Attendant Non-Entry Rescue

If an entrant becomes unable to perform a self-rescue, the attendant will attempt to rescue the entrant by use of a mechanical device from outside of the space. This attempt to rescue must not invoke further injury to the entrant nor to the attendant. Retrieval equipment or methods must meet the following requirements:

1. Each authorized entrant must wear a full body safety harness attached to retrieval equipment. Wristlets may be used instead of the harness only if the harness creates a greater hazard to the entrant.
2. Retrieval lines must be attached to a mechanical device (hoist) or a fixed point outside of the space prior to entry. The hoist must be ready to use for emergency situations prior to entry into the confined space.
3. For vertical entrances 5 feet or greater in depth, a tripod and retrieval hoist must be setup.
4. For horizontal entrances, at a minimum, a rope or other means must be attached to the harness so that the attendant can pull the entrant out.

Emergency Response Personnel

If emergency response personnel are needed, use two-way radio communication or a campus telephone to contact the Public Safety Department (x2677). Clearly state to the dispatcher "this is an emergency" and provide the following information:

1. Location of the emergency.
2. Telephone number where the call is being made (if telephone is used).
3. Your name
4. What happened, the nature of the emergency?
5. What type of assistance may be needed?
6. If other help or first aid is being administrated.
7. Always stay on the telephone until all pertinent information is given and let the dispatcher hang up first.
8. Station someone at a location along the street or area access to flag down and direct emergency response personnel to the scene.

In compliance with the OSHA Standard, Duquesne University has provided emergency response personnel and Public Safety Department with a list of permit required confined spaces on campus and the potential hazards associated with each space. The University has extended the opportunity to the emergency response personnel to access any permit required confined space for the purpose of developing rescue plans and/or practicing rescue operations.

RECLASSIFYING A CONFINED SPACE

A space classified as a permit-required confined space may be reclassified as a non-permit confined space under the following conditions:

1. If the permit space poses no actual or potential atmospheric hazards and if all other hazards within the space are eliminated without entry into the space. The permit space may be reclassified as long as the non-atmospheric hazards remain eliminated.
2. If it is necessary to enter the permit space to eliminate hazards, such entry will be performed as a permit-required confined space entry. If testing and inspection during the entry demonstrate that the hazards within have been eliminated, the permit space may be reclassified for as long as the hazards remain eliminated.
3. Reclassification of confined spaces must be certified which states all hazards in a permit space have been eliminated. The certification must contain the date, the location of the space and the signature of the person making the determination. This certification will be on the back of the Entry Permit. The EHS Department must be contacted to help with and approval of this reclassification.
4. If a hazardous situation arises within a permit required confined space that has been reclassified to a non-permit confined space, each person in that space will exit the space immediately. The space will be re-evaluated and determined whether it must be reclassified as a permit required confined space.

NOTE: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards. Elimination of the hazards means the hazards no longer exist.

CONTRACTORS/SUB-CONTRACTORS SAFETY

Duquesne University will provide vital information to contractors/sub-contractors prior to them entering confined spaces on University premises. The following requirements must be conveyed to contractors/sub-contractors prior to entry:

1. The University contains permit required confined spaces and that entry is only granted through total compliance with a permit space program meeting the requirements of this Confined Spaces Program and adherence to Duquesne University's Confined Spaces Program.

2. Each contractor/sub-contractor's employees entering permit required confined spaces on Duquesne University premises must be certified in confined space entry training. Duquesne University will only provide site-specific training to outside contractors/sub-contractors.
3. Each contractor/sub-contractor to enter permit required confined spaces on University premises must provide appropriate working equipment required to ensure safe entry into that space.
4. The hazard(s) that have been identified within the confined space to be entered and the experience the University has had with that space.
5. Any precautions or procedures the University has implemented for the protection of employees in or near the space to be entered.
6. Coordinate entry procedures when both University employees and contractor employees are working in or near the permit space(s).
7. Debrief the contractor at the conclusion of the entry operations regarding the permit spaces program that was followed and if any hazards were experienced or created while working in the confined space.

In addition to complying with the permit space requirements that apply, each contractor/subcontractor utilized on campus to perform permit required confined space entry must:

1. Obtain any available information regarding the permit space hazards and entry operations form the University.
2. Coordinate entry operations with the University when both University employees and contractor/sub-contractor personnel will be working in or near permit spaces.
3. Inform the University of the Permit Space Program the contractor/sub-contractor will follow and any hazards confronted or created in the permit space, either through a debriefing or during the entry operations.

Appendix A: Definitions

Acceptable entry conditions - the conditions that must exist in a permit required confined space to allow entry and to ensure that employees involved in the entry can safely enter into and work within the space.

Attendant - an individual stationed outside one or more permit required spaces who monitors the authorized entrants and who performs all attendants' duties assigned.

Authorized entrant - an employee who is authorized to enter a permit required space.

Confined space - a space that is:

1. Large enough for the whole body to enter and perform assigned work in.
2. Has a limited or restricted means of entry or exit.
3. Is not designed for continuous occupancy.

Emergency - any occurrence (including the failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment - the surrounding and 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 action by which a person passes through an opening into a permit required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry permit - the written or printed document that is provided to allow and control 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(s) when entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry.

Hazardous atmosphere - an atmosphere that may expose employees to the risk of death, incapacitation, and impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

1. Flammable gas, vapor or mist in excess of 10% of its lower flammable limit (LFL).
2. Airborne combustible dust at a concentration that meets or exceeds its LFL, which can be approximated as a condition, which the dust obscures the vision at a distance of 5 feet or less.
3. Atmospheric oxygen concentration below 19.5% or above 23.5 %.
4. Atmospheric concentration of any substance for which a dose or permissible exposure limit (PEL) is published by OSHA and which could result in employee exposure in excess of its dose or PEL.
5. Any other atmospheric condition that is immediately dangerous to life or health.

Hot work permit - the written authorization to perform operations (riveting, welding, cutting, burning, heating, etc.) capable of providing a source of ignition.

Immediately dangerous to life or health (IDLH) - any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting - the displacement of the atmosphere in a permit space by a noncombustible gas (like nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Isolation - the process by which a permit required space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections lines, pipe, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Non-Permit Confined Space - a 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. These spaces require no prior approval or documentation for entry.

Permit Required Confined Space - a confined space that 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 smaller cross-section.
4. Contains any other recognized serious safety or health hazard. These spaces require an Entry Permit, attendant and entry supervisor.

Oxygen deficient atmosphere - an atmosphere containing less than 19.5 % oxygen.

Oxygen enriched atmosphere - an atmosphere containing more than 23.5% oxygen.

Prohibited condition - any condition in a permit required space that is not allowed by the Entry Permit during the period when entry is authorized.

Rescue service - the personnel designated to rescue entrants from permit spaces.

Retrieval system - the equipment used for non-entry rescue of persons from permit spaces.

Testing - process of identifying and evaluating the hazards that entrants may encounter during entry into a permit space.

Appendix B: Entry Plan for Utility Tunnels

I. Justification

Duquesne University's utility distribution tunnel system presents a unique situation in regards to confined space entry procedures and compliance with OSHA's Confined Space Standard 29 CFR 1910.146.

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. More importantly, normal confined space entry procedures are both impractical and do little to protect the health and safety of employees entering the utility tunnel system.

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

A. The utility tunnel system is a controlled access work area. Authorization is required to enter the utility tunnel system. Signs are posted on utility tunnel access areas stating that the utility tunnel system is a restricted access area. Specific utility tunnel entry procedures have been developed and implemented.

B. A considerable portion of the main tunnel system is designed for employees to enter through building mechanical rooms, walk through the tunnel passages and perform equipment maintenance. Blind ends, smaller tunnels of approximately 4' by 4' and tunnel sections accessible only through manholes do exist in certain areas.
   Two main means of egress (through mechanical rooms and manholes) exist in the main tunnel system except for blind ends.
   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 to employees.

C. Natural and mechanical ventilation is provided throughout the main tunnel system. There is little possibility for a hazardous atmosphere, as defined in 29 CFR 1910.146(b), to develop under normal operating conditions.
   An air quality survey of the tunnel system demonstrates that under normal operating conditions the existence of a hazardous atmosphere is a very remote possibility.

D. Although means of egress are restricted or limited, entrapment hazards as defined in 29 CFR 1910.146(b) do not exist in the utility tunnel system.

E. Under normal operating conditions, engulfment hazards as defined in 29 CFR 1910.146(b) do not exist in the utility tunnel system.

F. Other serious hazards (i.e., exposed energized electrical conductors, moving machinery or lines that discharge hazardous materials into the space) as defined in 29 CFR 1910.146(b) do not exist in the main tunnel system under normal operating conditions.

G. The most serious hazard is the potential for a utility line rupture. This potential hazard can be significantly reduced through preventive maintenance and engineering controls, such as installing additional means of egress and eliminating mechanical devices that might impede escape.

H. Normal confined space entry procedures, (i.e., use of retrieval equipment), are not practical and do not protect employees (and might actually hinder self-rescue) from the most significant potential hazard, a utility line rupture.
   Use of the "buddy system" and requiring all entrants to carry two-way communication equipment is a more effective method to protect employee health and safety.

I. Data collected on the utility tunnels is routinely reviewed with all affected employees who have participated in the development of the utility tunnel entry procedure.

II. Utility Tunnel Entry Procedure

A. Pre-Planning For Work in Utility Tunnels

1. The Supervisor of Utilities and Construction shall be notified prior to the entry of any individual into the utility tunnel system.
2. The Supervisor of Utilities and Construction shall be included in the pre-planning stage of non-maintenance employees.
3. Prior to entering utility tunnels, the supervisor and workers shall discuss the scope and sequence of the work.
4. Pre-planning shall include a discussion of all potential hazards, means and methods of hazard control and emergency plans including:
    a. Identities and locations of energized utility lines.
    b. Identities and locations of energized compressed air lines.
    c. Identities and locations of energized high voltage electrical conductors.
    d. Locations of hot surfaces.
    e. Signs and symptoms of heat exhaustion and heat stroke.
    f. Lighting.
    g. Means of communication.
    h. Means of entry and egress.
    i. Hazards created by work activity (i.e., chemical products and welding/cutting).
    j. External hazards (i.e., work in roadways and walkways).
    k. Identities of any job-site specific hazards.
    l. Means to control hazards (e.g., Personal Protective Equipment, ventilation/local exhaust or lockout/tagout).
    m. Utility line de-energization and lockout procedures.
    n. Potential emergency situations and plans.
5. 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 alternate means of egress.
6. Employees entering the utility tunnel system will use the "buddy system".
7. Employees working in the tunnel system shall carry a portable flashlight and two-way communication equipment at all times.
8. Protective leather gloves shall be worn when working in utility tunnels.
9. Other Personal Protective Equipment, required to control job specific hazards, shall be identified in job planning and will be worn by all personnel.
10. Supervisor and workers shall discuss job specific emergency procedures.
11. Hot work (i.e., welding, cutting and brazing) requires authorization by the Supervisor of Utilities and Construction. When hot work is performed, forced ventilation shall be provided and the atmosphere shall be monitored for oxygen content, flammable gases and vapors, and toxic air contaminants. Standard size welding gas cylinders shall not be taken into utility tunnels.
12. Entry into utility tunnels through manholes and/or mechanical rooms shall be entered following the non-permit required confined space entry procedures only after initial atmospheric testing has shown that no atmospheric hazards exist. All testing results must be recorded on the Entry Permit for verification that acceptable entry conditions exist. During entry, entrants will utilize atmospheric testing equipment while entry is in progress and the attendant will record test results every hour on the Entry Permit. This is to ensure acceptable entry conditions still exist during the entry.
13. Contact Public Safety and inform dispatcher which utility tunnel entrance will be entered.

B. Procedures for Utility 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 and:
    a. Assist injured to escape.
    b. Secure the jobsite.
    c. Contact the supervisor/manager of the job.
    d. Do not re-enter the tunnel until the hazard is identified, evaluated and eliminated.
2. If emergency assistance is required, use either the nearest telephone or two-way communication equipment to call the Public Safety Department (x2677). Clearly state to the dispatcher "this is an emergency" and provide the following information:
    a. Location of the emergency.
    b. Telephone number from where the call is being made (if telephone is used).
    c. Your name.
    d. What happened; nature of the emergency.
    e. What assistance is needed?
    f. Help or first aid that is being provided.

    If telephone communication is used, stay on the line until all information requested by the dispatcher is provided and let the dispatcher hang-up first.
3. Station someone at a highly visible location along the street to flag down and direct any emergency response personnel and vehicles to the scene of the emergency.
4. If required, render appropriate and prudent first aid until emergency personnel arrive on the scene.

Appendix C: Procedures for Entering Boilers and Pressure Vessels

General Background

1. Employees entering a boiler and/or pressure vessels may encounter one or more of the following hazardous conditions:
    a. Internal atmospheres that are oxygen deficient (less than 19.5%) or enriched (greater than 23.5%).
    b. Internal atmospheres that contain flammable or combustible vapors in concentrations in excess of 10% of the Lower Explosive Limit (LEL).
    c. Internal atmospheres contaminated by toxic substances.
    d. Limited or restricted means of entry or egress.
    e. Exposure to electrical or mechanical equipment associated with boilers and pressure vessels.
    f. Exposure to hot water, steam, or other vapors from the associated piping systems.
    g. Exposure to temperature extremes.
2. According to OSHA's Permit-Required Confined Spaces Standard (29 CFR 1910.146), two classifications of confined spaces exist:
    a. Permit-required confined space.
    b. Non-permit required confined space.

In order to enter a permit required confined space the employee must certify that the boiler or vessel is safe for entry and implement the permit required safety procedures or the boiler or pressure vessel must be reclassified as a non-permit required confined space prior to entry. A permit required confined space may be reclassified as a non-permit required confined space by the employer if the hazards are eliminated without entry into the space and the boiler or pressure vessel poses no actual or potential atmospheric hazards. Reclassification of a permit required confined space boiler or pressure vessel to a non-permit required confined space may be performed by the EHS department only (see "**Reclassifying a Confined Space"**).

Duquesne University and contractors'/sub-contractors' employees are responsible for properly preparing a boiler or pressure vessel for confined space entry. When appropriate, this includes verifying the boiler or vessel is safe for entry through isolation, lockout/tagout of specific components of devices, proper ventilation, and testing of the internal atmosphere.

Entry into a boiler or pressure vessel will not commence until all applicable safe procedures of this Confined Spaces Program - Procedures for Entering Boilers and Pressure Vessels have been completed and verified.

Safety Procedures

<u>Pre-Entry Procedures</u>

1. The water sides of boilers or pressure vessels must be effectively isolated from the system to prevent water, steam, vapor, and/or toxic materials from entering during entry.
    a. When the piping systems contain the appropriate number and types of valves, effective isolation may be obtained by a proper valve lineup. If the valves are insufficient, sections of the piping must be removed and/or blind flanges may be installed.
    b. When valves are used for isolation, proper lockout/tagout devices must be applied to ensure the valves are locked in the proper position. Regardless of the method used to isolate and lockout a valve, as a minimum, the employee will attach a "DANGER" tag to the valves.

NOTE: The use of a single shutoff or block valve is not considered effective isolation from hot water, steam, or toxic materials.

2. The boiler or vessel must be effectively isolated from the fuel supply line, sources of ignition and electrical power. As a minimum, the employee will attach a "DANGER" tag where appropriate and utilize proper lockout procedures at all sources of energy.
    a. The burners may be removed.
    b. The manual or safety shutoff valves on gas or oil lines must be closed, properly locked out, and "DANGER" tags attached.
    c. The electrical circuits to the ignition or electrical equipment must be secured by removing fuses, locking out or opening the circuit breaker and "DANGER" tags attached.
    d. Any mechanical equipment used with the boiler or pressure vessel such as moving grates or agitators must be properly locked out to prevent movement.
3. The fire sides of boilers discharging to a common stack must be isolated from the stack if any other boiler discharging to the common stack is firing. Isolation dampeners, louvers, etc. must be properly locked out to prevent operation and "DANGER" tags attached.
4. The water and fire side of boilers and the inside of pressure vessels are confined spaces that may have hazardous atmospheres. A hazardous atmosphere is defined as one that is deficient in or enriched with oxygen, contains flammable or combustible vapors in excess of 10% of the LEL, or contains toxic substances in excess of those established by OSHA. As a minimum, whenever one or more of the following exist, a hazardous condition should be suspected:
    a. A boiler which has been laid up with an inert gas.
    b. A boiler utilizing a medium other than water.
    c. A boiler which burns process gas or process waste.
    d. A pressure vessel that contained substances other than air, water, or steam.
5. Prior to entry into a water or fire side of a boiler or the inside of a pressure vessel, the atmosphere must be properly ventilated and tested in order to ensure a safe atmosphere for entry. The atmosphere must also be tested as the entry proceeds. Natural circulation of air may be sufficient ventilation for small boilers and pressure vessels. Forced ventilation such as fans or blowers may be required for larger boilers and vessels.

NOTE: Entry has occurred as soon as any part of the entrant's body breaks the plane of opening into the confined space.

6. The atmosphere on the water and fire sides of boilers and pressure vessels must be tested for oxygen content, flammable gases and vapors, and toxic air contaminants, in this order. All atmospheric testing must be recorded on the Entry Permit and entry may only occur if readings are within acceptable parameters listed on the Entry Permit.
   Testing for atmospheric hazards will be conducted prior to entry into a permit required confined space. This pre-entry testing will be performed in such a way without entering the confined space. The atmosphere within the confined space will be tested at three different levels (bottom, middle and top). Once acceptable entry conditions are verified, atmospheric testing will be continuous during entry and these results (and the time) will be recorded on the Entry Permit every hour. If at any time the monitoring instrument sounds an alarm or fails to operate properly, entry must stop and all entrants will leave the space immediately.
   Direct reading monitoring equipment is required to conduct atmospheric testing. The instrument must be calibrated and in good working condition prior to use. Monitoring equipment will be maintained according to the manufacturer's specifications to ensure proper operation during atmospheric testing and entry.

7. All safety precautions, guidelines and general requirements listed in the **Confined Space Entry** - Permit Required section of Duquesne University's Confined Spaces Program must be followed prior to, during and after boiler and pressure vessel confined space entry.