



LAWRENCE UNIVERSITY

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Confined Space Program

Introduction

Employees of Lawrence University may at times be required to enter into and perform work inside tanks, chests, sewers, vessels and other confined spaces. Due to the potentially hazardous nature of this work, Lawrence University has established a written program for confined space operations. This program will be updated on an annual basis.

Lawrence University's operating guidelines include the following:

1. Identify the confined spaces and hazards that may be encountered during entry.
2. Provide safe work practices and supply proper equipment necessary to protect the employee's safety and health when entering into a confined space.
3. Train employees about the potential hazards of confined space entry, the procedures necessary for safe entry, and proper use of the equipment provided for entry.
4. Establish and maintain an adequate and appropriate rescue response procedure.

The following hazards may be encountered within a confined space:

Hazardous Atmospheres:

1. Flammable Atmosphere – occurring from an oxygen-enriched atmosphere, vaporization of flammable liquids, chemical reactions, concentration of combustible dust, desorption of chemicals from inner wall surfaces, and other causes.
2. Toxic Atmosphere – occurring from a manufacturing process, from material stored or present (decomposing organic material can liberate hydrogen sulfide), and from an operation being performed (welding, brazing, and combustion by-products).
3. Irritant Atmosphere – corrosive gasses and solvent vapors.
4. Asphyxiating Atmosphere –resulting from oxygen deficiency, oxygen displacement by another gas, and oxygen absorption by material stored in a confined space.

Potential Safety Hazards:

1. Release of hazardous energy.
2. Recontamination in confined space by chemical transfer, pressurized water, steam or gasses.
3. Communication and illumination problems.
4. Entry and exit time limitations or emergency rescue of injured workers.
5. Physical hazards such as heat, cold, noise, vibration, radiation, and fatigue.
6. Engulfment by materials in the space.
7. Internal configuration of space such as internal baffles or a sloping floor leading to pipe inlets, into which a person could slip and fall.

A. Identification and Assessment of Confined Spaces

1. All confined spaces shall be identified.
2. All entrances or portals into a confined space must be permanently posted. Signs shall include, but not necessarily be limited to the following information:

DANGER

CONFINED SPACE

ENTRY BY PERMIT ONLY

3. Identify the confined space either by name or number. This name or number should appear on the sign or in the immediate vicinity of the sign. The name or identification number shall also appear on the entry permit for that space.
4. The location of some entry portals, such as manholes, may be located in a floor, traffic aisle, roadway, or other area where signs are not easily maintained. For these spaces the sign may be omitted, but the supervisor will ensure, through training or other methods, that all employees understand these spaces are confined spaces and that confined space entry procedures apply.
5. Standardized confined space signs are available.
6. If the confined space contains hazardous chemicals, the space must be labeled according to Hazard Communication Identification or other regulatory requirements.

Confined Space Hazard Assessment

1. An assessment will be conducted for each confined space to identify hazards which may be encountered during entry. This hazard assessment will serve as a basis for developing safe entry procedures, employee awareness training, and to meet other requirements of the entry program.

Potential hazards to be considered in the assessment are:

- Oxygen deficiency or enrichment
 - Flammable gasses or vapors
 - Toxic materials
 - Engulfment in a vessel's contents
 - Physical agents (noise, heat, cold, radiation, etc.)
 - Deficiencies in lighting or communications
 - Hazardous energy requiring lockout and/or other methods of control.
 - Entry and exit restrictions requiring special procedures, especially in the event of emergency and rescue
2. An assessment will also be conducted to identify tasks requiring entry into the confined space. Alternate means of performing the task from outside the confined space, without having to enter the confined space, shall be evaluated and implemented when appropriate.

B. Operational Procedures

Entry Permit System

1. Entry into a confined space shall be by permit only.
2. The entry permit is an authorization and approval in writing that specifies the location and type of work to be done, certifies that all existing hazards have been evaluated, and lists the protective measures required to ensure the safety of all employees involved in confined space operations.
3. A supervisory person will be designated and have the authority to authorize entry into a confined space. The authorizer's signature on the permit verifies that all safety requirements have been met and that the space is safe to enter.
4. Items to be listed in the permit shall include:
 - a. The name or identification number of the confined space to be entered.
 - b. Description of the work to be performed.
 - c. Hazards that may be encountered.
 - d. The lockout procedure for control of hazardous energy.
 - e. Special clothing and equipment required prior to entry:
 - Personal protective equipment and clothing, including respiratory protection
 - Safety harness and/or lines
 - Tools approved for use in the hazardous location
 - Approved electrical equipment
 - f. Appropriate atmospheric testing equipment for:
 - Oxygen deficiency or enrichment
 - Flammable/explosive gasses or vapors
 - Toxic substances
 - g. Atmospheric monitoring requirements before and during entry.
 - h. Identification of employees who are authorized to enter the space.
 - i. Name of the attendant(s) at the point of entry.
 - j. Emergency procedures, including communications and rescue equipment.
5. The person performing the pre-entry atmospheric testing shall sign the entry permit.
6. The entry permit shall be reissued with every change in the work force or after the space has been vacant long enough to allow changes in atmospheric conditions. This includes revalidating all of the entry requirements.
7. The entry permit shall be posted at the point of entry to the confined space.
8. Entry permits shall be maintained for a period of one year. Air sampling results of employee exposure will be maintained as required by law.

C. Entry Team Assignments

1. At a minimum, the entry team for all confined space operations requires two members: (1) the person entering the confined space and (2) an attendant at the point of entry .
2. The attendant shall be stationed outside the point of entry as long as the entrant is inside the confined space.

The attendant shall:

- Not enter the confined space or leave the area unless relieved by a similarly trained and authorized person.

- Allow only authorized persons to enter the space, know who is in the confined space at all times, and maintain communication with the worker(s) inside the confined space via visual contact, voice, line contact, or two-way radio.
- Know the established emergency response and rescue procedures and be able to quickly summon assistance in case of an emergency.
- Maintain safe conditions outside the confined space to assure that nearby operations do not expose the person(s) inside the confined space to unsafe conditions.
- Monitor continuous air sampling instrumentation and forced air ventilation equipment and tend lifelines and other safety equipment.
- In the event of an emergency, the attendant shall:
 - Sound the alarm initiating self-rescue and summoning the rescue team.
 - If self-rescue is not successful, extract the employee(s) using established retrieval methods without entering the space.
 - Upon arrival of the rescue personnel, provide support as directed by the rescue personnel.

The entry person(s) shall:

- Enter the confined space only after the posting of an authorized entry permit.
- Enter the confined space only when the attendant is stationed at the point of entry.
- Exit the confined space whenever the attendant is required to leave their designated location outside the confined space.
- Exit the space upon order of the attendant or the activation of any alarm device.
- Notify the attendant and immediately exit the confined space upon developing any signs or symptoms indicative of chemical overexposure, upon the failure of any protective equipment, or when encountering any situation not identified by the hazard assessment or provided for in the entry procedures.

D. Rescue Procedures

1. Lawrence University has established rescue procedures for confined space emergencies. These rescue procedures include self-rescue, extraction without entering the space, rescue by entry into the space (if practical), and rescue by outside emergency personnel.
2. To the maximum extent possible, the primary rescue procedures shall be the extraction of the employee(s) without the rescuer having to enter the space.
3. A minimum of two persons will be designated and trained to perform a rescue if it would become necessary.

Employee rescue personnel will:

- Be provided with and be trained in the use of personal protective equipment and rescue equipment (i.e. safety belts, harnesses, lifelines, etc.)
 - Be trained to the level of the entry personnel.
 - Be trained in the assigned rescue functions.
 - Have personnel in the immediate area trained in basic first aid/CPR.
4. A rescue team from an outside agency must be informed of the hazards they may encounter. This must include information on the hazards of any chemicals found in the space.

E. Pre-Entry Preparations and Atmospheric Testing

Pre-Entry Atmospheric Testing

1. The air testing performed shall be appropriate to the hazards of the space being entered. Sufficient tests shall be performed to obtain a true representation of all areas in the confined space.
2. All pre-entry testing shall be completed from outside the confined space, to the maximum extent possible.
3. Air sampling test results shall be entered on the entry permit and must be repeated whenever the permit is reissued. It shall also be repeated prior to reentry if the confined space has been vacant long enough for a change in the air quality in the space.
4. All air testing shall be done by or under the supervision of a person knowledgeable in air sampling techniques. This knowledge should include the use, calibration, and limitations of the instrumentation, as well as the ability to reliably interpret the results.

Air sampling may include:

Oxygen - When testing is performed, the first test conducted must be the oxygen concentration. Test results below 19.5 percent are considered oxygen deficient. Concentrations above 23 percent are considered an oxygen enriched environment. Results between 19.5 and 23 percent are acceptable for confined space entry.

Note: For most combustible gas meters the accuracy of the flammability test depends upon the oxygen concentration. Do not proceed with flammability test if oxygen results are outside the acceptable range.

Flammability - This test is to be performed if there is any possibility for the presence of flammable or combustible gasses or vapors. Test results below 10 percent of the lowest flammable limit are acceptable for confined space entry.

Toxic Substances - Tests for toxicity shall be performed whenever the presence of toxic substances within the confined space is possible. The specific toxic substance(s) must be determined through the hazard analysis. Testing instruments specific to the toxic substance are required.

The atmosphere within a confined space is safe to enter if the toxicity test results do not exceed the most restrictive of:

- The current Threshold Limit Values published by the American Conference of Governmental Industrial Hygienists.
 - Legislative/regulatory permissible limits.
 - Permissible limits contained in the Material Safety Data Sheet for the chemical.
5. Whenever atmospheric testing indicates that the confined space is not safe to enter, remedial action shall be taken to render the space safe. This may include ventilation, purging, additional cooling/warming, and other techniques.

F. Cleaning

1. The confined space shall be cleaned of any potentially harmful substances by draining, purging, steaming, washing, or other effective method. To the extent possible, this shall be done from outside the confined space.

2. Care should be taken during cleaning to ensure that the cleaning chemicals do not react with the chemical contents of residues to form toxic or hazardous substances.

G. Ventilation

1. Ventilation must be provided to achieve an acceptable air quality within the confined space prior to entry. Air quality is assured through continuous atmospheric testing.
2. Mechanical ventilation (portable air movers or similar equipment) are used when positive displacement of air is required.
3. Continuous mechanical ventilation shall be used during confined space operations involving hot work, painting, and cleaning with toxic or hazardous substances.
4. Natural ventilation can be used when it has been determined to be adequate due to the absence of air contaminants, the configuration of the space, and the availability of openings for air to enter and leave the space.

I. Isolation and Lockout

1. All hazardous energy associated with the confined space shall be de-energized and locked out according to the established lockout procedure.
2. All pipes, hoses, ducts, and other supply and discharge lines shall be disconnected, banked off, or double blocked and bled to ensure that no gasses, liquids, materials or substances can enter the confined space.
3. In continuous systems where complete isolation is not possible, such as sewers or utility tunnels, specific written safety procedures shall be developed and enforced.
4. Conformance to all lockout requirements must be recorded on the entry permit.

J. Electrical Precautions

1. Electrical shock or ignition hazards must be eliminated where hazardous conditions exist. Atmospheric conditions or chemicals present within a confined space may mandate the use of electrical equipment rated for work in hazardous location.
2. Portable electrical equipment used for work in confined space shall meet:
 - a. The National Electric Code, Article 250-45, which mandates grounding of plug connected equipment in hazardous and conductive locations; or
 - b. Equivalent government standards
3. Examples of suitable equipment includes low voltage supply lighting, double insulated power tools, air-driven power tools, and ground fault circuit interrupters.
- 4.

K. Hot Work

1. All welding, cutting, or brazing work requires a hot work permit
2. All hot work requires the use of continuous mechanical ventilation.
3. Whenever continuous mechanical ventilation is not adequate, appropriate respiratory protection shall be provided.
4. Compressed gas cylinders shall not be taken into the confined space. Hoses carrying compressed gasses for use in hot work shall only be present during actual use and shall be withdrawn whenever not in use.

L. Instrumentation

Atmospheric testing Instruments

1. All instruments shall be maintained and calibrated according to the manufacturer's instructions.
2. All instruments used shall be inspected and calibrated prior to each use.
3. Instrument limitations relative to temperature, humidity, interfering chemicals, and other factors must be observed.

M. Respiratory Protection

1. The use of respiratory protection equipment is not required inside the confined space if the space has been determined to have acceptable air quality.
2. When respiratory protection is required to an unsafe atmosphere, only SCBA's or airline respirators with escape modules may be used. Lawrence currently does not own this equipment.
3. Respirator protection shall comply with governmental standards for respiratory use. These standards require a written respiratory protection program which includes such items as fit testing, maintenance, medical clearance, and user training.

N. Retrieval and Extraction Equipment

1. Workers entering confined spaces must wear a safety harness attached to a lifeline. This is to allow extraction of the employee(s) from the confined space during an emergency without the rescuer having to enter the space.
2. Where a hazard assessment has determined that the use of lifelines attached to the employee's harness or safety belt poses the danger of entanglement, alternate methods for rescue may be implemented.
3. Whenever a lifeline is in use, the free end shall be affixed outside the confined space in a manner that will prevent the lifeline from being pulled into the space. Preferably, it will be attached to a winch, hoist or other mechanical device which will assist in extraction. Only hand-operated retrieval devices shall be used for rescue purposes.
4. All lifelines and harnesses must be inspected prior to each use.

O. Post-Entry Requirements

1. Prior to vacating the space and returning it to its original use, it shall be determined that all personnel, equipment, and materials have been removed and that reactivating the space can be done in a safe manner.
2. A report shall be completed whenever a situation not anticipated in the entry procedure is encountered. A revision to the procedure that addresses the encountered hazard shall be completed prior to the next required entry into that confined space.
3. A written report shall be kept on file, along with a copy of the entry permit at the Corporate office.

P. Education and Training

1. All employees involved in confined space operations shall receive education and training appropriate to their responsibilities. All education and training must be documented.

2. Awareness Level Education:
 - Awareness Level Education shall be provided on an annual basis to all employees whose work duties bring them into contact with confined spaces.
 - This program should focus on the recognition of confined spaces, the general hazards encountered during entry, and the company/facility's entry program. The intent of this training is to prevent unauthorized entry.
 - Topics appropriate for inclusion in this program are:
 - General overview of the written confined space entry program.
 - The facility labeling system for confined spaces.
 - The hazards encountered in confined spaces.
3. Entry Level education and training:
 - Employees who are required to enter confined spaces or serve as attendants shall receive education and training annually.
 - Subjects which may be appropriate for inclusion in this program are:
 - Program orientation and entry permit system
 - Emergency entry and exit procedures including drills
 - Use of respiratory equipment, when appropriate
 - First aid and CPR
 - Isolation and lockout procedures
 - Potential hazards
 - Safe work practices
 - Atmospheric testing and monitoring
 - Safety equipment use
 - Fire protection
 - Communications
4. In addition, employees serving as attendants must be trained in procedures for summoning emergency assistance and in the use of retrieval equipment.
5. Education and training for employees performing atmospheric testing:
 - Employees performing atmospheric testing must receive training and demonstrate proficiency in the use of the instrument provided.
 - Training shall include:
 - The use, care, and calibration of the instruments.
 - Instruction into the limitations and interferences of the instruments.
 - Instruction into the meaning of the regulatory limits or exposure guidelines used to determine if the atmosphere in the space is safe to enter.
6. Education and training for permit authorizers:
 - In signing the entry permit and authorizing entry into a confined space, the permit authorizer is certifying that the confined space is safe to enter and that all necessary precautions have been taken to prevent harm to the employees who will perform the entry.
 - The permit authorizer shall receive education and training in all aspects of confined space operations.

Q. Auditing Program Compliances and Effectiveness

1. This program will be audited for compliance with established requirements and to ensure its continued effectiveness annually.