LEADER'S GUIDE:
CONFINED SPACE ENTRY PROGRAM

U.S. ARMY SAFETY CENTER

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Section I
Introduction

Many work places contain spaces that are considered to be “confined” because their configurations hinder the activities of employees who must enter into, work in or exit from them. In many instances, employees who work in confined spaces also face increased risk of exposure to serious physical injury from hazards such as engulfment and hazardous atmospheric conditions. The confinement itself may pose entrapment hazards. Additionally, work in confined spaces may keep employees closer to hazards such as machinery components. Confinement, limited access and restricted airflow can result in hazardous conditions that would not normally arise in an open workplace. The term “permit-required confined space” and “permit space” refer to spaces that meet the Occupational Safety and Health Administration’s (OSHA) definition of a “confined space” and contain health or safety hazards. For this reason, OSHA requires workers to have a permit to enter these spaces

This guide provides Army leaders with the basic tools necessary to establish, Implement, and sustain a Confined Space Entry Program in accordance with Chapter 3, AR 385-10, and The Army Safety Program, which adopts Occupational Safety and Health Administration (OSHA) safety standards and directs Army compliance.

The goals of the Confined Space Entry Program:

a. Protect Army personnel (soldiers, DA civilians, and contractors) who are subjected to permit-required confined space hazards. The primary concern is to protect personnel who are working in spaces that are large enough and so configured that an employee can bodily enter and perform assigned work; spaces that have limited or restricted means for entry or exit; unfavorable natural ventilation, and spaces that are not designed for continuous employee occupancy. Some examples of confined space work areas are: boilers, cupolas, degreasers, furnaces, pipelines, pits, pumping stations, fuel cells, septic tanks, silos, storage tanks, utility vaults, vats, or similar enclosures. The primary standards covering permit-required confined spaces are: OSHA Standards 29 CFR 1910.146, General Industry, 29 CFR 1926.21, Construction Industry, and US Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1.
b. Protect personnel from confined space related accidents through effective education, engineering, administrative controls, and aggressive enforcement of standards. This guide does not apply to tunnels specifically designed for human occupancy or confined space entry as it applies to Army watercraft. See FM 55-502 for guidance on watercraft confined space.
c. Apply a hierarchy of control measures to every job site where permit required confined space entry has been identified through a comprehensive job hazard analysis.
d. Reduce confined space accident costs associated with lost time and worker’s compensation claims.
e. Improve mission capability and increase the overall well-being and productivity of the work force.

The hierarchy of control measures targeted toward eliminating, or significantly reducing the risks associated with confined space entry hazards in the workplace are:

a. **Engineering Controls.** Those controls which eliminate or reduce the hazard through implementation of sound engineering practices. Ventilation is one of the most common engineering controls used in confined spaces. When ventilation is used to remove atmospheric contaminants from the confined space, the space should be ventilated until the atmosphere is within the acceptable ranges. Ventilation should be maintained during the occupancy if there is a potential for the atmospheric conditions to move out of the acceptable range. When ventilation is not possible or feasible, alternate protective measures or methods to remove air contaminants and protect occupants should be determined by the qualified person prior to authorizing entry. Conditions regarding continuous forced air ventilation should be used as follows:

(1) Forced air ventilation should be so directed as to ventilate the immediate areas where an employee is or will be present within the space.

(2) Continuous ventilation is maintained until all employees have left the space.

(3) Air supply for forced air ventilation should be from a clean source.

b. **Work Practice (Administrative) Controls.** Those (administrative) controls are those controls which eliminate or reduce the hazard through changes in the work practice (e.g., rotating workers, reducing the amount of worker exposure, housekeeping). Confined spaces should be cleaned/decontaminated of hazardous materials to the extent feasible before entry. Cleaning/decontamination should be the preferred method of reducing exposure to hazardous materials. Where this is not practicable, personal protective equipment (PPE) should be worn by the entry personnel to provide appropriate protection against the hazards which may be present.

c. **Personal Protective Equipment (PPE)**. If the hazard cannot be eliminated or reduced to a safe level through engineering and/or work practice controls, PPE should be used. A qualified person should determine the PPE needs of all personnel entering the confined space, including rescue teams. PPE which meet the specifications of applicable standards should be selected in accordance with the requirements of the job to be performed.

Section II
Definitions

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

Attendant—A trained individual stationed outside one or more confined spaces who monitors authorized entrants and performs all attendant's duties assigned in the permit space program.

Authorized entrant --- A worker who is authorized by the employer to enter a permit required confined space.

Blanking or blinding—The absolute closure of a pipe, line, or duct, by fastening across it a solid plate or cap that completely covers the bore and is capable of withstanding the maximum pressure of the pipe, with no leakage beyond the plate.

Confined space—A space that: Is large enough and configured so a worker can bodily enter and perform assigned work; and has limited or restricted means for entry or exit (for example: tanks, vessels, silos, storage bins, hoppers, vaults, manholes, and pits are spaces that may have limited means of entry); and is not designed for continuous human occupancy.

Confined Space Program Team – Members involved in the installation, unit, or project confined space entry program.

Double block and bleed - The isolation of a confined space from a line, duct, or pipe by locking or tagging two closed in-line valves and locking or tagging open to the outside atmosphere a drain or bleed in the line between the two closed valves.

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

Engineering Controls. Those controls which eliminate or reduce the hazard through implementation of sound engineering practices.

Engulfment - The surrounding and effective capture of a person by liquid or finely divided 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 --- Any 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 confined space.

Entry permit. The written or printed documentation that is provided by the employer to allow and control entry into a permit required confined space and that contains the information specified in 29 CFR 1910.146, Appendix D.

Entry supervisor. The person (such as employer, foreman, crew chief, or supervisor) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorized entry and overseeing entry operations, and for terminating entry if a change in conditions warrant. The entry supervisor may also perform attendant or entrant duties if trained and equipped. The duties of the entry (on-site) supervisor may be transferred from one person to another during the course of the entry operation. This transfer of responsibility must be documented by either a signature or initials on the entry permit.

Hazardous atmosphere—An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following cases:
a. A flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL).
b. An airborne combustible dust at a concentration that meets or exceeds its LFL.
c. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.
d. An atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in 29 CFR 1910, Subpart G, Occupational Health and Environmental Control or in Subpart Z, Toxic and Hazardous Substances, that could result in an employee exposure in excess of its dose or permissible exposure limit.

Note. For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazardous Communications Standard, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

e. Any other atmospheric condition that is immediately dangerous to life or health (IDLH).

Hot work permit --- The employers written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition. The form is usually issued by the installation fire department.

Immediately dangerous to life or health (IDLH) — Any condition that poses an immediate or delayed threat to life, which would cause immediate or delayed adverse health effects or that, would interfere with a worker's ability to escape unaided from a permit-required space.

Inerting— Displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Isolation—Positively preventing any unwanted form of energy (or other agent with a serious potential for hazard) from entering the confined space through the use of blanking, double block and bleed, or lockout and (or) tagout.

Line breaking — The intentional opening in a confined space of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, inert gas, or any fluid at volume, pressure or temperature capable of causing injury.

Non-permit confined space—A space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazards capable of causing death or serious physical harm.

Oxygen-deficient atmosphere—An atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen-enriched atmosphere—An atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space (permit space) — A confined space that has one or more of the following characteristics:
a. Contains or has a potential to contain a hazardous atmosphere.
b. Contains a material that has the potential for engulfing the entrant.
c. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
d. Contains any other recognized serious safety or health hazard.

Permit-required confined space program (permit space program) — The overall program for controlling, and where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Permit system --- The employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition —Any set of conditions in a permit space where the hazard potential exceeds the limits authorized by the entry permit.

Rescue service --- The personnel designated to rescue employees from permit spaces.

Retrieval system —The equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit space.

Testing --- The process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Section III
Duties and Responsibilities

Successful implementation of a Confined Space Entry Program requires a coordinated effort. As you design the program for your installation or facility, give careful thought to who the participants should be, and make sure they are involved in the process from the beginning. Below is a list of individuals who may be key players in the confined space entry program as well as a brief description of their respective roles in the development process:

▪. **Commanders of Major Army Commands (MACOMs), and Regional Installation Management Agency (IMA) Directors.** Commanders will ensure their subordinate commanders and directors implement a Confined Space Entry Program and ensure OSHA standards for confined space entry are strictly enforced.

▪. **Installation Commanders.** Installation commanders will implement a Confined Space Entry Program in accordance with AR 385-10, The Army Safety Program, OSHA Standards 29 CFR 1910, General Industry, 29 CFR 1926, Construction Industry, and the US Army Corps of Engineers safety and health requirements contained in EM 385-1-1. They will provide the necessary resources, and delegate sufficient authority to subordinate commanders/directors and division chiefs to implement the program.

▪. **Installation Safety Managers.** The installation Safety Manager will develop and implement the installation Confined Space Program for the installation commander. The program should consist of a comprehensive written program document for facilities management. The Safety Manager and his/her staff may be called upon to provide guidance and technical assistance to commanders/directors regarding implementation of and compliance with elements of the Confined Space Entry Program, and should integrate the program elements into existing Standard Army Safety and Occupational Health Inspection (SASOHI) criteria in order to ensure compliance during evaluations. In addition, the Safety Staff may be called upon to provide, or assist with training.

▪ **Unit Level Organizations.** Each organization having tasks that require entry into confined spaces should be responsible for its related portions of the confined space entry program, and accomplish it through assistance from the installation safety office.

▪ **Commanders and Directors.** (29 CFR 1910.146 refers to *employer* which is synonymous with *commander/director)*.

a. Ensure that a list of confined spaces, both permit required and non-permit, under the control of the organization or function, is maintained.
b. Provide a copy of all confined spaces listed, both permit required and non-permit, to the host installation safety manager, fire chief, and Preventive Medicine Officer.
c. Ensure required equipment is procured and is in compliance with confined space standards.
d. Ensure personnel assigned confined space duties are adequately training and certified.
e. Establish a written confined space entry program for each organization conducting confined space entry operations

f. Designate a representative responsible for implementing the confined space program.
g. Review all non-permit confined spaces within their area of responsibility at least annually to ascertain that no changes occurred which would affect the original classification.
h. Ensure that cancelled permits are reviewed for lessons learned.

▪ **Confined Space Coordinator.** The person designated by the organization's commander or director to manage the activities where confined space entry has been identified through comprehensive job hazard analysis. The hazard assessment should identify the sequence of work to be performed in the confined space, the specific hazards known or anticipated, and the control measures to be implemented to eliminate or reduce each of the hazards to an acceptable level. No entry should be permitted until the hazard assessment has been reviewed and discussed by all persons engaged in the activity. Confined Space Coordinators are also responsible for the following:
a. Ensuring requirements for confined space entry have been completed before entry is authorized.
b. Ensuring confined space monitoring is performed by personnel qualified and trained in confined space entry procedures.
c. Notifying the Fire Department or other rescue teams before beginning and when completing confined space operations.
d. Ensuring that the rescue team has simulated a rescue in a confined space within the past twelve months.
e. Knowing the hazards that may be faced during entry, including the mode, signs or symptoms, and consequences of exposure.
f. Filling out a permit, determining the entry requirements, and requiring a permit review and signature from the authorized entry supervisor.
g. Notifying all involved employees of the permit requirements and posting the permit in a conspicuous location near the job.
h. Renewing the permit or have it reissued as needed (a new permit is required every shift).
i. Determining the number of attendants required to perform the work and ensuring the attendant knows how to communicate with the entrants and how to obtain assistance.
j. Posting any required barriers and signs.
k. Remaining alert to changing conditions that might affect the conditions of the permits, (i.e., require additional atmospheric monitoring or changes in personal protective equipment).
l. Changing and reissue the permit, or issue a new permit as necessary.
m. Ensuring periodic atmospheric monitoring is done according to permit requirements.
n. Ensuring that personnel doing the work and all support personnel adhere to permit requirements.
o. Ensuring the permit is canceled when the work is done; and ensuring the confined space is safely closed and all workers are cleared from the area.

▪ **Entry (on-site) supervisor.** An entry supervisor is a qualified person authorized to approve confined space entry permits. This person should be responsible for:
a. Determining if conditions are acceptable for entry.
b. Authorizing entry and overseeing entry operations.
c. Terminating entry procedures as required.

d. Serving as an attendant, as long as the person is trained and equipped appropriately for that role.
e. Ensuring measures are in place to keep unauthorized personnel clear of the area.
f. Checking work at least twice a shift to verify and document permit requirements are being observed (more frequent checks should be made if operations or conditions are anticipated that could affect permit requirements).
g. Ensuring that necessary information on chemical hazards is kept at the work site for employees or rescue team.
h. Ensuring a rescue team is available and instructed in their rescue duties (e.g., an onsite team or a prearranged outside rescue service), and ensuring at least one member of the rescue team has current certification in first aid and CPR.

▪ **Confined Space Entrants**. Personnel who are granted permission to enter a confined space should:
a. Read and observe the entry permit requirements.
b. Stay alert to the hazards that could be encountered in a confined space.
c. Use the protective equipment required by the permit.
d. Immediately exit the confined space when ordered to do so by the attendant, an automatic alarms sound, they perceive they are in danger, or they notice physiological stresses or changes in themselves or co-workers (e.g., dizziness, blurred vision, shortness of breath).

▪ **Confined Space Attendant.** The Attendant should be stationed outside the work space and should:
a. Be knowledgeable of, and be able to recognize potential confined space hazards.
b. Maintain a sign-in/sign-out log with a count of all persons in the confined space and ensure all entrants sign in/sign-out.
c. Monitor surrounding activities to ensure the safety of personnel.
d. Maintain effective and continuous communication with personnel during confined space entry, work and exit.
e. Order personnel to evacuate the confined space if he/she:
(1) Observes a condition which is not allowed on the entry permit.
(2) Notices the entrants acting strangely, possibly as a result of exposure to hazardous substances.
(3) Notices a situation outside the confined space which could endanger personnel.
(4) Notices within the confined space a hazard which has not been previously recognized or taken into consideration.
(5) Must leave his/her work station or must focus attention on the rescue of personnel in some other confined space that he/she is monitoring.
f. Immediately summon the Rescue Team if crew rescue becomes necessary; and keep unauthorized persons out of the confined space, order them out, or notify authorized personnel of the unauthorized entry.

▪ **Rescue Team.** The Rescue Team members must:
a. Complete a training drill using mannequins or personnel in a simulation of the confined space prior to the issuance of an entry permit for any confined space and at least annually thereafter.

b. Respond immediately to rescue calls from the Attendant or any other person recognizing a need for rescue from the confined space.
c. In addition to emergency response training, receive the same training as that required of the authorized entrants; and have current certification in first-aid and CPR.

▪ **Contracting Officer (CO).** The contracting officer, typically through the Contracting Officer's Representative, will ensure that the requirements of the installation Confined Space Program are integrated into all applicable contracts, and that contractors understand when either they or their sub-contractors perform work on the installation or facility, they must adhere to the established guidelines set forth in the program document. Contractors will be informed of this requirement as well as the on-site construction rules that apply during the pre-construction conference.

▪ **Contracting Officer's Representative (COR).** The COR shall ensure all construction contracts, prior to start of construction, include specific sections which address confined spaces, and that contractors comply with the USACE manual 385-1-1 IAW FAR 52.236-14. It is the contractor's responsibility to provide confined space entry protection to all workers exposed to confined space hazards, and to ensure that they have been properly trained. Contractors shall submit a written confined space entry plan as part of the contract, which includes training requirements for their workers as well as subcontractor workers, to the COR for review and approval. The COR shall ensure that the contractor does not begin any construction-related activities until the submitted confined space entry Plan has been approved. Confined space entry will be one of the main topics discussed during the Pre-Construction Conference.

▪ **Civilian Personnel Officer.** The civilian personnel officer will provide support to supervisors and other individuals responsible for enforcing the Confined Space Program requirements. An example of support would be to develop job descriptions, which address requirements for personnel assigned to work in confined spaces hazard areas, and the necessity to utilize confined space protective equipment as a condition of employment. In addition, the civilian personnel officer will advise supervisors with respect to appropriate disciplinary measures when personnel fail to comply with established confined space entry protection requirements.

▪ **In-house Design.** Responsible individuals should strive to eliminate confined space hazards in the design of new buildings, facilities, and equipment by engineering-in various systems and modifications designed to eliminate the need to enter confined spaces. Signs shall be permanently installed to identify confined spaces that will require routine maintenance repair work.

▪ **Army Design Managers.** The Army Design Managers shall ensure that architects and engineers incorporate the U.S. Army Corps of Engineers safety design guides, mil handbooks, and design manuals in the design effort to eliminate of control confined space hazards whenever possible.

▪ **Maintenance Work.** The COs/CORs and Army safety personnel shall ensure that all maintenance contract work performed by contractors, to include work encompassing confined space entry requirements, is performed in accordance with USACE manual EM 385-1, 29 CFRs 1910.146 and applicable ANSI standards. Army maintenance workers shall be trained to recognize the hazards of confined space entry in the work place and the use of required protective equipment.

▪ **The Army Surgeon General** should provide professional advice and guidance applicable to confined space in the realm of sampling, analysis, and health risk appraisals and (or) hazard evaluations.

▪ **Assistant Chief of Staff for Installation Management (ACSIM**) should provide professional advice and guidance applicable to confined space in the realm of fire protection and emergency rescue.

▪ **Installation Fire Chief** should:
a. Provide rescue support for confined space entries according to local agreements.
b. Provide confined space entry rescue support to tenant units and contractors according to local support agreements.
c. Ensure the fire prevention representatives on confined space rescue teams are trained in confined space requirements. Each individual should have attended a formal confined space course. If the person has not attended a formal confined space course, the Fire Chief will ensure the person has adequate experience in confined space operations.
d. When requested, assist the commander or director in obtaining training for entrants, entry supervisors, and organizational rescue teams.
e. Assist in identification and selection of required equipment, to include PPE and self-contained breathing apparatus (SCBA), for organizational rescue teams.
f. Coordinate unit or contractor entry and exit times to ensure rescue personnel are available and ready.

▪ **Industrial Hygienist** should:
a. Enroll all personnel who may enter confined spaces in the installation respiratory protection program.
b. Ensure that the industrial hygiene representative(s) are trained in confined space requirements.
c. Provide local training on the use, calibration (user), and care of atmosphere testing and monitoring equipment. Certify organizational personnel, as required, to test confined spaces. If unable to support this requirement, the industrial hygienist should assist in identifying a training resource.
d. Document the location of each confined space with the information provided by the commander or director.
e. Assist in training personnel for confined space duties.
f. Evaluate worker exposure to hazardous chemicals.
g. Assist in the selection of appropriate respiratory equipment and other PPE.
h. Assist commanders, directors, and entry supervisors in the selection of proper PPE.
i. Assist entry supervisors in the interpretation of monitoring results.

j. If certified organizational personnel are not available:

(1) Evaluate confined spaces for hazardous atmospheres and Immediately Dangerous to Life and Health (IDLH) conditions as necessary to meet mission requirements.

(2) Sample the atmosphere in the confined space as often as may be required to ensure changing conditions do not result in unacceptable atmospheres.

Section IV
Training Requirements

Commanders will, in accordance with 29 CFR 1910.146, provide training so that all employees whose work is regulated by this section acquire the understanding, knowledge, and skills necessary for the safe performance of their duties in confined spaces. Training should be provided to each affected employee:

a. Before the employee is first assigned duties under this section and when there is a change in assigned duties.

b. Whenever there is a change in permit space operations that presents a hazard for which an employee has not been trained.

c. Whenever the employer has reason to believe either that there are deviations from the permit space entry procedures required in this section or that there are inadequacies in the employee's knowledge or use of these procedures.

The training should establish employee proficiency in the duties required by this section and should introduce new or revised procedures, as necessary, for compliance with this section.

▪ **General training.** All employees who will enter confined spaces will be trained in entry procedures. Personnel responsible for supervising, planning, entering or participating in confined space entry and rescue will be adequately trained in their functional duties prior to any confined space entry. Training should include:

a. Explanation of the general hazards associated with confined spaces.

b. Discussion of specific confined space hazards associated with the facility, location or operation.

c. Reason for, proper use, and limitations of PPE and other safety equipment required for entry into confined spaces.

d. An explanation of permits and other procedural requirements for conducting a confined space entry;

e. A clear understanding of what conditions would prohibit entry.

f. How to respond to emergencies.

g. Duties and responsibilities as a member of the confined space entry team.

h. A description of how to recognize symptoms of overexposure to probable air contaminants in themselves and co-workers, and method(s) for alerting attendants.

▪ **Specific training for atmospheric monitoring personnel.** Training should include proper use of monitoring instruments such as:

a. Proper use of the equipment.

b. Knowledge of calibration.

c. Knowledge of sampling strategies and techniques.

d. Knowledge of PELs, TLVs, LELs, UELs, etc.

▪ **Specific training for Attendants.** Training should include the following:

a. Procedures for summoning rescue or other emergency services.

b. Proper utilization of equipment used for communicating with entry and emergency/rescue personnel.

▪ **Specific training for rescue and emergency services personnel.** Training must include:
a. Recognition of permit space hazards.
b. Control of permit space hazards.
c. Use of atmospheric monitoring equipment.
d. Use and maintenance of rescue equipment.
e. Annual practice of permit space rescues.
f. Proficiency in first aid and cardiopulmonary resuscitation (CPR).
g. Documentation of training.

▪ **Important rescue training considerations:**
a. Ensure that the rescuer does not travel a greater distance than allowed by the air supply, self-contained breathing apparatus (SCBA), and escape cylinders. Analyze distance, space configurations, physical obstacles, and total time needed to enter the space, perform the rescue operations, and leave the space.
b. Leave the space immediately whenever a problem arises with respiratory protection equipment or whenever the attendant orders evacuation.

▪ **Verification of training.** Periodic assessment of the effectiveness of employee training should be conducted by a qualified person. Training sessions should be repeated as often as necessary to maintain an acceptable level of personnel competence.

▪ **Documentation of training.** All confined space training for entry supervisors, entrants, attendants, testers and (or) monitors, and rescue team members will, in accordance with 29 CFR 1910.146, be certified, documented, and kept up-to-date. The certification should contain each individual's name and dates of training or retraining and either the initials or signature of the trainer and (or) instructor. Training should be documented for safety related items such as CPR or respirator use, or on an authorized computerized information management system

Section V
GENERAL REQUIREMENTS

▪ **Identification of Confined Spaces.** The commander, in coordination with the Confined Space Coordinator, should evaluate the workplace to determine if any spaces are permit-required confined spaces. See flow chart at Appendix B. If permit-required confined spaces are identified, the commander or assigned Confined Space Coordinator will inform exposed workers, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces. Note. A sign reading "DANGER – PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign. See appendix D for an example of the sign. If the commander decides that its workers will not enter permit spaces, the commander shall take effective measures to prevent its workers from entering the permit spaces. If the commander decides that workers will enter permit spaces, he/she shall develop a written permit space program that complies with this section. The written program shall be available for inspection by workers and their authorized representatives.

▪ **Written Confined Space Program.** Among other things, the OSHA standard requires the written program to:
a. Implement necessary measures to prevent unauthorized entry.
b. Identify and evaluate permit space hazards before allowing workers entry.
c. Test atmospheric conditions in the permit space before entry operations and monitor the space during entry.
d. Perform appropriate testing for the following atmospheric hazards in this sequence; oxygen, combustible gases or vapors, and toxic gases or vapors.
e. Establish and implement the means, procedures and practices to eliminate or control hazards necessary for safe permit space entry operations.
f. Identify employee job duties.
g. Provide and maintain, at no cost to the employee, personal protective equipment and any other equipment necessary for safe entry and require employees to use it.
h. Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations.
i. Coordinate entry operations when employees of more than one employer, or contractor, are working in the permit space.
j. Implement appropriate procedures for summoning rescue and emergency services, and preventing unauthorized personnel from attempting rescue.
k. Establish, in writing, and implement a system for the preparation, issue, use and cancellation of entry permits.
l. Review established entry operations annually and revise the permit space entry program as necessary.
m. Implement the procedures that any attendant who is required to monitor multiple spaces will follow during an emergency in one or more of those spaces.

▪ **Alternative to a full permit entry.** Under certain conditions described in 29 CFR 1910.146, the commander may use alternate procedures for worker entry into a permit space. For example, if an employer can demonstrate with monitoring and inspection data that

the only hazard is an actual or potential hazardous atmosphere that can be made safe for entry using continued forced air ventilation, the commander may be exempted from some requirements, such as permits and attendants. However, even in these circumstances, the employer must test the internal atmosphere of the space for oxygen content, flammable gases and vapors, and the potential for toxic air contaminants before any worker enters it.

▪ **Alternate procedures.** Alternate procedures can be used to enter a confined space when:
No other hazards exist.
Atmospheric hazards can be effectively removed and controlled by forced ventilation.
Workers can safely enter and do work in the space .
All testing results and monitoring data are documented, retained, and made available to each employee who enters the space.

▪ **"Safe for Entry".** This is a general safety guideline of 50 percent of the permissible flammable level or permissible toxic substance level recommended during confined space entry under the alternate procedures. Under the alternate procedures, permit space safety is maintained solely by continuous forced air ventilation. It is important to prevent the atmosphere inside the confined space reaching hazardous concentrations to ensure that, in the event of ventilation failure (such as a fan breakdown), the workers will still have enough time to recognize the hazards and leave the space.

▪ **Initial Testing and Evaluation of Confined Space Conditions.** Some gases or vapors are heavier than air and will settle to the bottom of a confined space. Also some gases are lighter than air and will be found around the top of the confined space. Therefore, it is necessary to test all areas (top, middle, and bottom) of a confined space with properly calibrated testing instruments to determine what gases are present. If testing reveals oxygen-deficiency, or the presence of toxic gases or vapors, the space must be ventilated and re-tested before workers can enter. If ventilation is not possible and entry is necessary (for emergency rescue for example), workers must have appropriate respiratory protection. Never trust your senses to determine if the air in a confined space is safe. You cannot see or smell many toxic gases and vapors, nor can you determine the level of oxygen present. Entry supervisors, in coordination with the Confined Space Coordinator, should test for and evaluate many factors prior to classifying a confined or enclosed space. Such evaluations will include, but are not necessarily limited to, the following considerations:
a. The contents or previous contents of the space that may result in the presence of flammables, toxic materials, or oxygen-deficient or enriched atmospheres.
b The location and configuration of the space, including restricted access, obstructions, remoteness, etc., which may inhibit or interfere with movement, ventilation, rescue efforts, or fire fighting efforts.
c Potential hazards from the external environment, such as the proximity of liquid oxygen (LOX) storage operations, petroleum, oil, and lubricants (POL) storage areas, sewer and waste water treatment processes, and underground disposal sites, which could affect the atmosphere within the confined space.
d. The types of operations that are conducted within the space, particularly those which by the very nature of the process produce toxic materials, flammables, oxygen depletion or enrichment, or ignition sources.

e. Fixtures, devices, or equipment within the space that may create or contribute to hazardous conditions including piping systems, conduits, ducts, machinery, pressurized lines, etc.
f. The presence of other hazards such as slippery surfaces, deteriorated or unstable portable ladders, irritant or caustic materials, etc. Pay attention to the condition of permanently-installed ladders, such as those with metal rungs embedded into concrete walls of manholes or other structures.
g The boundary spaces and their contents to ensure fire or explosion is not caused in these spaces by the operation being conducted.
h. Initial testing that shall be performed from outside the space. Testing into the interior of the space may be performed by drop tests or insertion of sample probes and hoses into the space. Testing should be performed in the following sequence:

(1) **Test oxygen content**. Combustible gases are tested after tests for oxygen content because the threat of fire or explosion is more immediate and more life threatening, in most cases, than exposure to toxic gases and vapors.

Oxygen deficient atmosphere: An oxygen deficient atmosphere has less than 19.5% available oxygen. Any atmosphere with less than 19.5% oxygen should <u>not</u> be entered without an approved self-contained breathing apparatus (SCBA). The oxygen level in a confined space can decrease because of work being done, such as welding, cutting, or brazing; or it can be decreased by certain chemical reactions (rusting) or through bacterial action (fermentation). The oxygen level is also decreased if oxygen is displaced by another gas, such as carbon dioxide or nitrogen. Total displacement of oxygen by another gas, such as carbon dioxide, will result in unconsciousness, followed by death.

(2) **Flammable Hazard**. Many combustible gas indicators and (or) explosimeters require oxygen for proper operation (generally 10- to 30-percent oxygen by volume). Corrections for known flammable components, if different from the calibration gas, should be made according to the manufacturer's instructions.

Flammable Atmospheres: Two things make an atmosphere flammable: 1) the oxygen in air; and 2) a flammable gas, vapor, or dust in the proper mixture. Different gasses have different flammable ranges. If a source of ignition (e.g., a sparking or electrical tool) is introduced into a space containing a flammable atmosphere, an explosion will result. An oxygen-enriched atmosphere (above 21%) will cause flammable materials, such as clothing and hair, to burn violently when ignited. Therefore, never use pure oxygen to ventilate a confined space. Ventilate with normal air.

(3) **Toxic Materials**. For the determination of initial confined space classification, chemical substances known or expected to be present shall be measured and evaluated for their potential to produce a hazardous atmosphere.

Toxic Atmospheres. Most substances (liquids, vapors, gases, mists, solid materials, and dusts) should be considered hazardous in a confined space. Toxic substances can come from the following:
a. The product stored in the space; The product can be absorbed into the walls and give off toxic gases when removed or when cleaning out the residue of a stored product, toxic gases can be given off.
b. The work being performed in a confined space: Welding, brazing, panting, scraping, sanding, degreasing, etc. Toxic atmospheres are generated in various processes. For

example, cleaning solvents are used in many industries from cleaning/degreasing. The vapors from these solvents are very toxic in a confined space.

▪ **Classification of Confined Spaces.** Confined spaces are classified on the basis of measurements of the oxygen content, flammability, and toxicity by testing (use table 3.1.). This table is based upon existing or potential confined space hazards. Confined spaces are also classified relative to material contained in the space that could cause engulfment or are configured in a manner that could result in entrapment and (or) asphyxiation. All personnel will assume confined spaces are permit-required until proven otherwise by means of testing and (or) inspection.
a. Permit-required confined spaces may contain hazards that present a situation that is immediately dangerous to life and health (IDLH) or has a potential for or contains a hazardous atmosphere.
b. Non-permit confined space contains no hazardous atmosphere. The entrants will not perform any work that could cause a hazardous atmosphere. The space does not have a potential for engulfment and is not configured in a way that would cause entrapment or asphyxiation. Permits and signs are not required.

▪ **Approved Equipment.** Before purchasing equipment to support the confined space entry program, coordinate with the Confined Space Coordinator to ensure testing and monitoring equipment used in confined spaces is approved for use in Class I, Division 1 and the appropriate group atmosphere, as defined in NFPA 70, The National Electrical Code (NEC), Article 500, Hazardous (Classified) Locations. Only direct reading equipment with current calibration should be used. The supervisor should also ensure equipment meets required standards of safety as determined by an appropriate Nationally Recognized Testing Laboratory (NRTL) as listed in the OSHA NRTL Program--Underwriters' Laboratories (UL), Factory Mutual Research Corporation (FMRC), etc. Group classifications are provided in NFPA 497M, Manual for Classification of Gases, Vapors, and Dust for Electrical Equipment in Hazardous Locations. Guidance is also provided in National Materials Advisory Board (NMAB) 353-5, Classification of Gases, Liquids, and Volatile Solids Relative to Explosion-Proof Electrical Equipment.

▪ **Testing of Confined Spaces.** Testing, also called verification testing, should be accomplished prior to entry into permit-required confined spaces. This testing should be done by a qualified person who is trained and certified. Testing for classification of confined spaces is accomplished by a technically qualified professional member of the organization's confined space team.

▪ **Calibration of Monitoring Equipment**. Monitoring equipment used to evaluate confined spaces should be calibrated in accordance with the manufacturer's instructions. Some monitoring equipment (e.g., colorimetric tubes) does not require calibration. Equipment that comes with manufacturer-approved calibration devices is also acceptable. Monitoring equipment that requires calibration, but cannot be calibrated locally, should be sent to the manufacturer for calibration. The user should field check equipment according to the manufacturer's instructions, immediately before testing the confined space. Workers should

not use equipment that cannot be calibrated or which fails the field check, until it is repaired and the calibration and (or) field check is successfully accomplished.

▪ **Atmospheric Monitoring**. Many operations may generate hazardous conditions and may require atmospheric monitoring as the work progresses to ensure safe conditions are maintained. The frequency and types of testing are dependent upon prevailing conditions and the nature of the operations. No single rule can be established for all operations and conditions. The entry supervisor, with assistance from the Confined Space Coordinator, should establish the frequency and type of tests for atmospheric monitoring and should enter these requirements on the entry permit. The continuous monitoring of oxygen levels, flammable vapor levels, and toxicity levels should be considered for all permit-required confined space operations. The entry supervisor with appropriate assistance as stated above should carefully evaluate the following types of operations for continuous atmospheric monitoring:

a. Work that has the potential of generating hazardous concentrations of toxic materials. (Examples: welding, cutting, brazing, soldering, etc.)

b. Application of preservatives, paints, epoxies, solvents, etc., which may involve hazardous concentrations of toxic or flammable vapors.

c. Cleaning operations, sludge removal, etc., which may produce or cause release of hazardous concentrations of toxic or flammable vapors.

d. Any similar operations that possess the potential for producing or releasing toxic, flammable, or asphyxiating atmospheres or material into the space.

Table 3.1. Confined Spaces Classification-Atmospheric Condition.

	PERMIT REQUIRED	NON-PERMIT
PARMETER	**CONFINED SPACE**	**CONFINED SPACE**
Characteristics	**Immediately dangerous to life or health (IDLT). Potential for or has contained a hazardous atmosphere.	No hazardous atmosphere with no creditable potential for a hazardous atmosphere, engulfment, or entrapment.
Oxygen	Less than 19.5 percent *(less than 148 mm Hg) or greater than 23.5 percent *(less than 179 mm Hg).	19.5 percent – 23.5 percent - *149 – 179 mm Hg).
Flammability	Greater than 10 percent lower Explosive Limit (LEL).	Less than or equal to 10 percent LEL.
Toxicity	An atmosphere concentration of any chemical substance over the occupational exposure limit (OEL) which is capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects.	An atmosphere concentration of any chemical substance, regardless of OEL, which is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects.

*Based upon a total atmospheric pressure of 760 mm Hg (sea level).
**Immediately Dangerous to Life or Health -- as referenced in National Institute for Occupational Safety and Health (NIOSH), Registry to Toxic and Chemical Substances, Manufacturing Chemists data sheets, or other recognized authorities (see definition in Appendix A).

Section VI
SPECIFIC REQUIREMENTS

▪ **Entry into Confined Spaces**. Entry supervisors should ensure workers enter a permit-required confined space ONLY after an approved entry permit has been obtained. The permit is an authorization and approval in writing that specifies the location and type of work to be done. It also certifies an evaluation of all existing hazards and the necessary protective measures have been taken to ensure the safety and health of each worker.

▪ **Permit system**. Before entry begins, the entry supervisor identified on the permit shall sign the entry permit to authorize entry. The completed permit shall be made available at the time of entry, to all authorized entrants or their authorized representatives, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed. The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit.
The entry supervisor shall terminate entry and cancel the entry permit when:
a. The entry operations covered by the entry permit have been completed.
b. A condition that is not allowed under the entry permit arises in or near the permit space.
The commander/manager shall retain each canceled entry permit for at least 1 year to facilitate review of the permit-required confined space program. Any problems encountered during an entry operation shall be noted on the pertinent permit so that the appropriate revisions to the permit space program can be made.

▪ **Entry Permit.** The entry permit that documents compliance with 29 CFR 1910.146 shall identify:
a. The permit space to be entered.
b. The purpose of the entry.
c. The date and the authorized duration of the entry permit.
d. The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space.
e. The personnel, by name, currently serving as attendants.
f. The individual, by name, currently serving as entry supervisor, with a space for the signature or initials of the entry supervisor who originally authorized entry.
g. The hazards of the permit space to be entered.
h. The measures used to isolate the permit space and to eliminate or control permit space hazards before entry.
i. The acceptable entry conditions.
j. The results of initial and periodic tests, accompanied by the names or initials of the testers and by an indication of when the tests were performed.
k. The rescue and emergency services that can be summoned and the means (such as equipment to use and the numbers to call) for summoning those services.
l. The communication procedures used by authorized entrants and attendants to maintain contact during the entry.
m. Equipment, such as personal protective equipment or testing equipment.

n. Any other information whose inclusion is necessary, given the circumstances of the particular confined space, in order to ensure workers safety.
o. Any additional permits, such as hot works, which have been issued to authorize work in the permit space.

▪ **Testing and Classification of Confined Spaces**. Testing and classification of confined spaces should be done by a qualified person who is trained and certified according to the requirements in Section V. Initial testing should be performed from outside the space. Testing into the interior of the space may be performed by drop tests or insertion of sample probes and hoses into the space. Testing should be performed in the sequence outlined in Section V, Initial Testing and Evaluation of Confined Space Conditions.

▪ **Entry into Known Immediately Dangerous to Life and Health (IDLH) Conditions Permit-Required Confined Spaces**. Entry supervisors should not permit entry into and work in known IDLH spaces under normal operations. Entry supervisors should authorize entry only under the following circumstances:
a. Efforts are made to reduce the hazard within the confined space by isolation, ventilation, or other techniques to result in a lower classification confined space. If efforts to reduce the hazard to a lower classification confined space are unsuccessful, entry into known IDLH spaces is authorized only in cases of EXTREME EMERGENCY such as rescue efforts, emergency repairs, etc.
b. The permit for entry into known IDLH confined space is approved by the entry supervisor prior to space entry.
c. The permit authorizes entry into a specific confined space, for a specific purpose, by specific work crews, and for a work period, which will normally not exceed a single shift. If multiple shifts are necessary, either a new entry permit should be completed or the entry supervisor may approve a continuation of the initial permit with a new entry supervisor and crew members. Rescue team entry is exempt from this requirement.
d. Personnel entering confined spaces with known or estimated IDLH conditions should wear a positive pressure SCBA or a supplied-air respirator with escape SCBA. In addition, personnel will be equipped with a harness of a type suitable to permit extraction of the person (does not become a hindrance to the extraction), a lifeline securely attached to the harness, and such other necessary PPE suitable for the conditions and exposures. NOTE: When the use of a lifeline would present additional hazards, other alternatives must be considered.
e. Emergency rescue personnel, equipped with the above listed equipment and any additional equipment that may be necessary to effect a rescue, are stationed immediately outside the entry to the confined or enclosed space.
f. Communications by sight or voice or both are established and maintained between the person entering the space and attendant personnel outside the space.
g. Only explosion-proof or intrinsically safe equipment is used where flammable or explosive atmospheres are present. (Reference NFPA 70, Article 504, Intrinsically Safe Systems, and Article 501, Class I Locations).
h. A qualified safety official is present during all known IDLH confined space entry and work periods. The safety official serves as a safety consultant to the person in charge of entry.

i. A qualified fire protection specialist is present during all known IDLH space entries when the atmosphere inside the space contains flammable or explosive contaminants or is oxygen enriched. EXCEPTION: If the installation fire department emergency rescue team is stationed on the scene, the fire protection specialist is not required.

▪ **Entry Into Permit-Required Confined Spaces**. Permit-required confined spaces contain atmospheres or conditions that are, or may reasonably be expected to become, hazardous (but are not IDLH) (see table 3.1.). Flammables, toxic materials, or deviations of oxygen levels within a permit-required space may be due to the materials and conditions within the space or may be created by the operations conducted in the space.

a. Commanders/directors will prepare an entry permit after they have documented the completion of the following measures:

Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to specifying acceptable entry conditions and providing each authorized entrant with the opportunity to observe any monitoring or testing of permit spaces; isolating the permit space; purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards; and verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.

b. Permits, issued by an entry supervisor will permit entry into a specific confined space, for a specific purpose, by a specific work crew, for a period not to exceed a single shift or as determined jointly by commander and confined space program members. Rescue team entry is exempt from this requirement.

c. Where the contaminations are caused by materials or conditions within the space, the entry supervisor will identify the cause or source of the contamination and remove it to the maximum degree possible by cleaning, ventilating, or other such treatments.

d. Where the operations to be conducted within the space introduce (or have the potential to introduce) additional hazards within the space, the entry supervisor should ensure these hazardous conditions and operations are covered by the permit and take action consistent with the nature of the operations to control the hazards and maintain safe conditions within the space.

(1) Where toxic materials are or may be introduced into the space, the entry supervisor should provide personnel within the space with NIOSH-approved respiratory protective equipment suitable for the exposure. The entry supervisor should contact the local industrial hygiene staff for assistance in selecting the appropriate respiratory protective equipment and other PPE as determined necessary to protect against skin contact.

(2) Entry supervisors should ensure that only explosion proof or intrinsically safe equipment is used where flammable or explosive atmospheres are present. (Reference NFPA 70, Articles 504 and 501.)

e. Entry supervisors should ensure personnel entering a permit-required confined space are suited with a harness and lifeline of a type suitable to permit extraction of the person (does not become a hindrance to the extraction) from the space. They will also ensure the lifeline is securely attached to the harness and adequate attachment points outside the confined space are available and used. NOTE: When the space is so configured that the use of a lifeline would present additional hazards, they should not be used.

f. The entry supervisor should verify the rescue services are available and the means for summoning them are operable.
g. The entry supervisor should ensure an attendant is provided for all permit-required confined space entry and work. The entrants and attendant outside the space should establish and maintain communications. The attendant should know the procedure and have the capability to contact the rescue team or summon emergency assistance if the rescue team is not stationed immediately outside the confined space.
h. When initial testing indicates ventilation is required to remove detected contaminants and (or) provide adequate oxygen levels, the entry supervisor should ensure ventilation is provided during entry and occupancy of the space.
i. When operations to be conducted inside the confined space have the potential to cause an IDLH atmosphere without industrial ventilation, the entry supervisor should ensure ventilation (general dilution, or local exhaust) is used to maintain the atmosphere within the space.
j. For routinely recurring work in permit-required confined spaces (e.g., sewers, fuel cells, dikes, communication vaults) where the spaces may be entered on a regular basis, the commander may develop an SOP that is approved by safety, fire protection, and industrial hygiene personnel. All master entry plans should be reviewed by the above representatives and the organizational commander at least annually, to ensure conditions have not changed. Using the SOP as a guide, the entry supervisor should prepare an entry permit. The entry supervisor should authorize entry into the confined space by signature on the entry permit and should ensure the following conditions are met:

(1) There is no known potential for an IDLH atmosphere or an engulfment.

(2) The entrants are trained in routine recurring operations practices and procedures required for such entries.

(3) The work operations are governed by an SOP, TM or similar directive.

(4) The space is tested for atmospheric hazards.

(5) The permit is revoked whenever any testing required by this section shows conditions in the space are more hazardous than contemplated under the permit. The entry supervisor will stop operations and ensure a new permit is issued. Retain the revoked permit for 1 year. The permit is revoked when any conditions of the permit are not followed or enforced.

k. The entry supervisor may reclassify a permit-required confined space to a non-permit confined space at the time of a specific entry. Such reclassification would allow entry without a permit, without personnel being suited with a harness and (or) a lifeline, and without an attendant, provided:

(1) Testing is accomplished prior to entry with the results showing the space to be free of all hazards. NOTE: If entry is required to eliminate the hazards in the permit space, the entry should be made with an entry permit according to Section VI, Entry into Permit-Confined Spaces). Once the hazards have been eliminated, the space may be reclassified as non-permit as long as the hazards remain eliminated.

(2) That actual or potential atmospheric hazards are eliminated, and continuous monitoring is used to ensure the atmosphere remains free of hazards. That all hazards within the space are eliminated without entering the space at the time of testing, and any non-atmospheric hazards remain eliminated.

(3) That during routine work, the entrant does not take tools or introduce material into the space that could cause a hazard.

(4) The entrant does not perform any work that would cause a hazardous condition.

(5) The entry permit is revoked whenever any test, monitoring instrument, or observation shows hazardous conditions are developing in the confined space more hazardous than allowed under the permit. When this occurs, the entry supervisor should secure the area and prevent entry until an approved entry permit is issued.

(6) The entry supervisor documents the basis for the reclassification on a separate sheet, attaches it to the entry permit, and signs or initials next to the statement. NOTE: Routine or repetitive entries for daily inspections of lateral fuel pits are examples of work tasks that may qualify to use the procedures of this paragraph.

▪ **Entry In to Non-Permit Confined Spaces**. These confined spaces are not considered hazardous and have no reasonable probabilities to become hazardous (see table 3.1.). These spaces are defined as confined because the design may have limited openings for entry and exit, and may also have limited space (lateral fuel pits under 5-feet deep, dikes less than 6 feet in height around fuel storage tanks).

a. Entries into non-permit confined spaces are allowed without an entry permit and require no attendants. NOTE: Even though the confined space is classified as a non-permit confined space, using typical criteria to evaluate hazards such as atmospheric, engulfment, or entrapment, the space may contain other physical hazards. Hazards such as slippery surfaces, or deteriorated pipe ladders, may make self-rescue difficult for the entrant. Also, fuel pits less than 5-feet deep with jet fuel accumulation due to line leakage may present a hazard to repair crews. In cases where no entry permit is required, it may be appropriate for entrants to use a body harness to facilitate rescue operations in case of problems, for an attendant to be assigned to monitor the entry process, or other special procedures developed to protect entrants.

b. Non-permit confined spaces should be reviewed periodically, at least annually, to ensure conditions have not changed which could result in a potential for hazards and a change in confined space classification. A non-permit confined space should be reevaluated any time a known change in mission occurs or new construction is planned which may affect the space or the area immediately adjacent to the space.

▪ **Welding, Cutting, and Brazing Permit**. Whenever workers perform hot riveting, welding, cutting or burning, or heating operations within a confined space, they should obtain a “hot work” permit from the installation fire department. If hazards may be introduced into the confined space due to the “hot work,” the industrial hygienist should be contacted to evaluate the potential hazards and recommend ventilation procedures. In addition, the workers should:

a. Inspect, test, operate, and maintain welding and cutting equipment such as hoses, connections, torches, etc.

b. Not take compressed gas cylinders or gas manifolds used in welding and cutting operations into a confined space.

c. Turn off gas supplies at the cylinder or manifold outside the space when equipment is unattended or unused for substantial periods of time, such as at breaks or lunch periods. At shift changes (30 minutes or more) or overnight, turn off gas supplies and remove torches and hoses from the space. Immediately remove open-ended hoses from the space when torches or other devices are removed from the hose.

d. Do not take electric arc units or machines into a confined space. Place such units outside the space.

PHYSICAL HAZARDS

Mechanical hazards. Some types of mechanical hazards may be encountered when working in a confined space. Moving equipment or parts and energized or pressurized systems can be dangerous. Examples include shafts, couplings, gears, belts, conveyors, mixers, rotors, and compressing devices.

Entrapment hazards. Inwardly converging walls or floors that slope downward and taper to a smaller cross-section (such as air plenums).

Engulfment. This refers to the surrounding or burial of the worker in a liquid or loose, finely divided solid material, such as settled grain. Such materials can suffocate a worker. Examples are, accidental dumping of a product on a worker, or a worker walking on unstable material such as settled grain. Such material could conceal a void underneath that gives way under the weight of the worker, resulting in engulfment.

THERMAL HAZARDS

A thermal hazard is a dangerous condition caused by excessive heat or cold on a hot surface. Workers engaged in continuous heavy work while wearing PPE in warm surroundings are particularly susceptible to thermal hazards. Heat stress may lead to heat exhaustion, heat cramps, heat stroke, and/or loss of consciousness.

Noise Impacts on confined space workers. Sounds generated by tools and heavy machinery can be magnified and reverberated within confined spaces. Noise may impede verbal communications between the entrants and the attendants or rescue personnel. Over time, excessive noise may also impair a worker's hearing. If noise levels are high, a hearing conservation program may need to be implemented.

General safety hazards. Snakes, rodents, lighting, obstructions, falling objects, wet surfaces, trip/falls, electrical shock, and acute chemical hazards may also need to be addressed.

Controls for Physical hazards.
Isolation includes identifying potential mechanical hazards and completing the de-energizing of all electrical, mechanical, pneumatic, and hydraulic systems and all other energy sources.

Section VII
EMERGENCY AND RESCUE PROCEDURES

Two thirds of all confined space fatalities occur among would-be rescuers. Fatalities can occur when the rescuers are overcome by their emotions, take unnecessary chances, do not know the hazards involved, do not have a plan of action, or lack confined space rescue training. After only four minutes without oxygen, it is very likely that a worker will experience asphyxiation, which may result in brain damage or death.

▪ **Rescue Service Personnel**. OSHA 29 CFR 1910.146 requires commanders and directors to ensure responders are capable of responding to an emergency in a timely manner. Commanders must ensure rescue service personnel are provided with personal protective and rescue equipment, including respirators.

▪ **Responsibilities**. The written confined space program should include emergency and rescue procedures consistent with the nature of each known operation that requires entry into a permit-required confined space. The entry supervisor should coordinate with the installation safety, fire protection, and industrial hygiene staffs when required to enter non-routine permit- required confined spaces not included in the written confined space program and establish emergency rescue procedures prior to entry. Three means of rescue include self-rescue, non-entry rescue, and entry rescue.

Self-Rescue. Self-rescue is vital because the entrant is:
a. Conscious and alert.
b. Able to recognize his or her own signs and symptoms.
c. Still physically able to evacuate the space more rapidly than waiting for someone else to rescue him or her.
d. Able to alert fellow workers of impending dangers.
e. Not endangering anyone else.
Employees should be trained to exit from the confined space according to requirements in Section V.

Non-entry rescue. Non-entry rescue is the next best approach when self-rescue is not possible because non-entry rescue can be started right away and prevents additional personnel from being exposed to unidentified and/or uncontrolled confined space hazards. Usually equipment and other rescue aids are employed to assist in removing endangered entrants. In situations where configuration of the space or other elements prevent the removal of the worker, entry rescue may be the only solution.

Entry rescue. Entry rescue involves rescuers entering the space to retrieve the entrant and/or provide the victim with emergency assistance such as CPR, first aid, and air via self contained breathing apparatus (SCBA) or a supplied air respirator (SAR), if needed. If there is even a remote possibility of other atmospheric contaminants, even though these readings appear to be within the normal ranges, rescuers should still use appropriate respiratory protection. Play it safe. Wear SCBA or SAR. Do not use air purifying respirators for

confined space rescue. An entry rescue plan needs to be developed ahead of time in the event of an emergency for which the non-entry rescue plan is not appropriate.

A thorough rescue plan includes:
a. A barricade area for crowd control.
b. Additional ventilation options.
c. Control of other hazards (cave-ins, traffic, etc.).
d. Protective clothing and equipment.
e. Appropriate lighting equipment (explosive-proof).
f. Methods of communication.
g. A stand-by rescue team.
h. Victim removal procedures and devices.
i. Available emergency vehicles.
j. Medically trained personnel.

Re-evaluate a rescue plan whenever:
a. Conditions change within the space.
b. Workers discover any new hazards.
c. There are changes in the rescue personnel and/or personnel availability.
d. New equipment is purchased.
e. Routine proficiency training results are unsatisfactory.
f. A rescue plan is found to be deficient (e.g., a failed simulated rescue).

Local agreement. According to local agreements, the installation fire department will normally provide rescue services for operations requiring entry into permit-required confined spaces on an Army installation. The supervisor in charge of entry into a confined space should contact the fire department prior to entering a permit-required confined space, to coordinate emergency rescue assistance and ensure its availability within a reasonable period of time. The entry supervisor should ensure these procedures are accomplished whenever emergency and rescue procedures are planned. When deemed appropriate by the fire chief, the rescue team should stand by at the scene (such as entry into permit-required confined spaces that are IDLH. Training requirements for rescue team members are located in Section V.

Off site rescue. When confined space work is performed outside the installation or area for which the installation fire department has responsibility or the installation fire department is unable to support the operation, the supervisor in charge of entry should ensure an off site rescue team is available or the confined space work is rescheduled. Off site rescue teams should consist of properly trained personnel equipped with appropriate PPE, including respiratory protection equipment necessary for entry into confined spaces, and with rescue and retrieval equipment suitable for the type of confined spaces involved.
a. Off site rescue teams should meet the same training requirements as entrants. In addition, the entry supervisor should ensure they are trained locally (if not in technical school) in the correct performance of the rescue functions assigned to them. Training, as a minimum, should include the use of retrieval and rescue equipment and proper wearing and

use of any PPE, including airline respirators or SCBA approved for confined space rescue that may be required during actual rescues.

b. In permit-required confined space operations, entry supervisors should ensure all members of the rescue team are trained in cardiopulmonary resuscitation (CPR) and first aid. The off site rescue team or installation fire department rescue team should be available at the scene for permit-required confined space entry under IDLH conditions.
c. Provide access to the space so that off-site rescue personnel can familiarize themselves with the site, develop a rescue plan in advance, and practice rescue operations.
d. The appropriate Confined Space Coordinator should assist as required in the selection of equipment for off site rescue teams.
d. The commander/director have overall responsibility for employee safety. The verification task is usually assigned to the entry supervisor. If the off-site rescue service indicates for any reason that it would be unable to respond to a rescue summons, *entry must not be authorized unless and until an adequate back-up rescue service is arranged and confirmed.*

▪ **Inspection of Safety Equipment**. Entry supervisors should ensure the inspection, testing, maintenance, and documentation of safety and rescue equipment are accomplished.

▪ **Harness and retrieval lines**. All authorized entrants and rescuers are required to use a chest or full body harness and retrieval lines, unless it is determined that the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue operation. Wristlets may be used if the commander/director can demonstrate that the use of a chest or full body harness is not feasible or creates a greater hazard. Also, the entry supervisor must ensure that the other end of the retrieval line is attached to a mechanical device or a fixed point outside the permit space. A mechanical device must be available to retrieve someone from vertical type permit spaces more than five feet deep. Only devices designed by the manufacturer and approved for moving humans should be used. The equipment must enable a rescuer to remove the injured worker from the space quickly without injuring the rescuer or further harming the victim.

▪ **MSDS**.
If an injured entrant is exposed to a substance for which a material safety data sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or other written information must be made available to the medical facility personnel treating the exposed entrant.

Section VIII
CONTRACTOR REQUIREMENTS

When an organization arranges to have a contractor perform work that involves a permit required space entry, the organization's commander or director shall:

a. Inform the contractor that the workplace contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of this section. Ensure the information is included in the statement of work (SOW) or equivalent contracting tool.

b. Apprise the contractor of the elements, including the hazards identified and the host commander's experience with the space that makes the space in question a permit space.

c. Apprise the contractor of any precautions or procedures that the host commander has implemented for the protection of workers in or near permit spaces where contractor personnel will be working.

d. Coordinate entry operations with the contractor, when both host command personnel and contractor personnel will be working in or near permit spaces.

e. Review emergency rescue responsibilities to determine whether the contractor supplies rescue team or if the installation fire department is expected to supply a rescue function.

f. Ensure the fire chief coordinates on the contract and either approves or disapproves the use of the rescue team if supplied by the contractor.

g. Apprise the contractor of requirements to notify the installation fire and emergency services when entry and exit to permit spaces are made.

h. Debrief the contractor at the conclusion of the entry operations regarding the permit space program followed, and regarding any hazards confronted or created in the permit spaces during operations.

i. In addition to complying with permit space requirements that apply to all employers, each contractor who is retained to perform permit space entry operations shall:

1) Obtain any available information regarding permit space hazards and entry operations from the host commander.

2) Coordinate entry operations with the host commander, when both host command personnel and contactor personnel will be working in or near permit spaces.

3) Inform the host commander of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.

Appendix A

GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS

References

American National Standards Institute (ANSI) Standard Z117.1, Safety Requirements for Confined Spaces.

National Fire Protection Association (NFPA) Standard 70, The National Electrical Code (NEC): Article 500, Hazardous (Classified) Locations; Article 501, Class I Locations; and Article 504, Intrinsically Safe Systems.

NFPA Standard 497M, Manual for Classification of Gases, Vapors, and Dust for Electrical Equipment in Hazardous Locations.

National Institute for Occupational Safety and Health (NIOSH) Registry to Toxic and Chemical Substances.

National Materials Advisory Board (NMAB) 353-5, Classification of Gases, Liquids, and Volatile Solids Relative to Explosion-Proof Electrical Equipment.

Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.146, Permit-Required Confined Space.

Abbreviations and Acronyms

ANSI—American National Standards Institute

CFR—Code of Federal Regulations

CPR—Cardiopulmonary Resuscitation

CSPT—Confined Space Program Team

FMRC—Factory Mutual Research Corporation

IDLH—Immediately Dangerous to Life and Health

LFL—Lower Flammable Limit

LOX—Liquid Oxygen

MACOM—Major Command

MSDS—Material Safety Data Sheets

NEC—National Electrical Code

NFPA—National Fire Protection Association

NIOSH—National Institute for Occupational Safety and Health

NMAB—National Materials Advisory Board

NRTL—Nationally Recognized Testing Laboratory

OI—Operating Instruction

OPR—Office of Primary Responsibility

OSHA—Occupational Safety and Health Administration

POL—Petroleum, Oils, and Lubricants

PPE—Personal Protective Equipment

SCBA—Self-Contained Breathing Apparatus

TSG—Surgeon General

SOW—Statement of Work

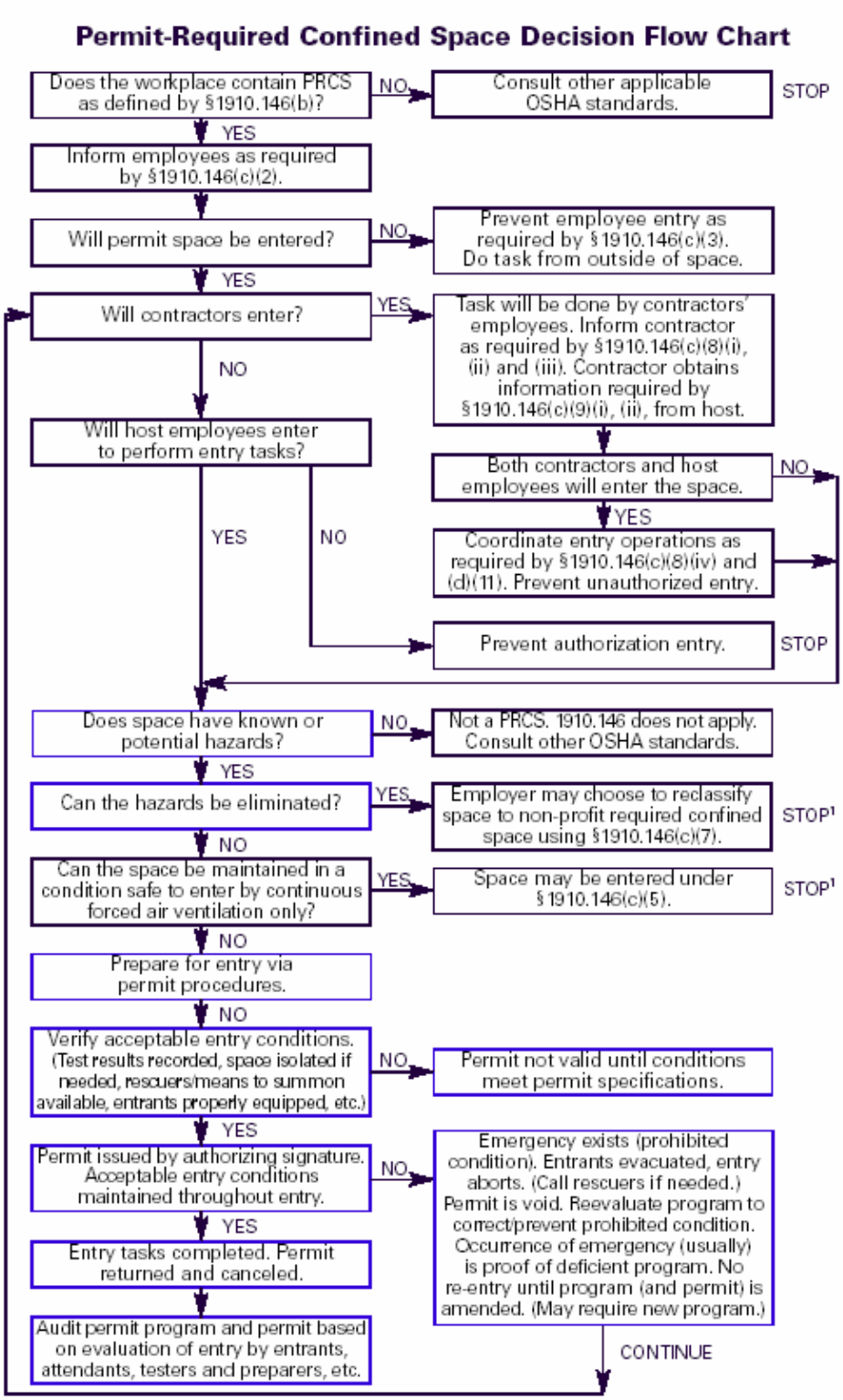
TMDE—Testing, Measurement, Diagnostic, and Evaluation

UL—Underwriters' Laboratory

US—United States

WWW—World-Wide Web

Appendix B



[1] Spaces may have to be evacuated and re-evaluated if hazards arise during entry.

Appendix C

RECOMMENDATIONS FOR A SAFE ENTRY: A CHECKLIST

Use the following checklist to evaluate the confined space.

DO NOT ENTER A CONFINED SPACE UNTIL YOU HAVE CONSIDERED EVERY QUESTION, AND HAVE DETERMINED THE SPACE TO BE SAFE.

YES	NO	
☐	☐	*Is entry necessary?*
☐	☐	*Are the instruments used in atmospheric testing properly calibrated?*

TESTING

☐	☐	*Was Oxygen at least 19.5 % - not* more *than 21 % ?*
☐	☐	*Were toxic, flammable, or oxygen-displacing gases/vapors present ?*

- *Hydrogen Sulfide*
- *Carbon Monoxide*
- *Methane*
- *Carbon Dioxide*
- *Other (list*) _____

MONITORING

☐	☐	*Will the atmosphere in the space be monitored while work is going on ?*
☐	☐	*Continuously?*
☐	☐	*Periodically? (If yes, give interval: _____)*

REMEMBER – ATMOSPHERIC CHANGES OCCUR DUE TO THE WORK PROCEDURE OR THE PRODUCT STORED. THE ATMOSPHERE MAY BE SAFE WHEN YOU ENTER, BUT CAN CHANGE VERY QUICKLY.

☐ ☐ **CLEANING**

Has the space been cleaned before entry is made ?

☐ ☐ *Was the space steamed?*

☐ ☐ *If so, was it allowed to cool ?*

YES **NO**

VENTILATION

☐ ☐ *Has the space been ventilated before entry?*

☐ ☐ *Will ventilation be continued during entry?*

☐ ☐ *Is the air intake for the ventilation system located in an area that is free of Combustible dusts and vapors and toxic substances?*

☐ ☐ *If atmosphere was found unacceptable and then ventilated, was it re-tested before entry?*

ISOLATION

☐ ☐ *Has the space been isolated from other systems?*

☐ ☐ *Has electrical equipment been locked out?*

☐ ☐ *Have disconnects been used where possible?*

☐ ☐ *Has mechanical equipment been blocked, chocked, and disengaged where necessary?*

☐ ☐ *Have lines under pressure been blanked and bled?*

CLOTHING/EQUIPMENT

☐ ☐ *Is special clothing required (boots, chemical suits, glasses, etc.)?*

(If so specify: _____)

☐ ☐ *Is special equipment required (e.g., rescue equipment, communications equipment, etc.)?*

(If so, specify: _____)

		Are special tools required (e.g., spark proof)?
		(If so, specify: _____)

YES NO

RESPIRATORY PROTECTION

		Are MSHA/NIOSH – approved respirators of the type required available at the worksite ?
		Is respiratory protection required (e.g., air-purifying, supplied air, self-contained breathing apparatus, etc.)?
		(If so, specify type: _____)
		Can you get through the opening with a respirator on?(If you don't know, find out before you try to enter.)

TRAINING

		Have you been trained in proper use of a respirator?
		Have you received first aid/CPR training?
		Have you been trained in confined space entry and do you know what to look for?

STANDBY/RESCUE

		Will there be a standby person on the outside in constant visual or auditory communication with the person on the inside?
		Will the standby person be able to see and/or hear the person on the inside?
		Has the standby person(s) been trained in rescue procedures?
		Will safety lines and harnesses be required to remove a person?
		Are organizational rescue procedures available to be followed in the event of an emergency?

		Are you familiar with emergency rescue procedures?
		Do you know who to notify and how in the event of an emergency?

YES **NO**

PERMIT

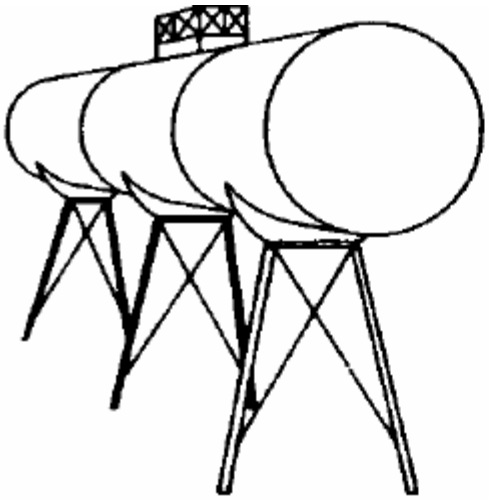
*(*The permit is an authorization in writing that states that the space has been tested by a qualified person, that the space is safe for entry; what precautions. Equipment, etc., are required; and what work is to be done.)

		Has a confined space entry permit been issued?
		Does the permit include a list of emergency telephone numbers?

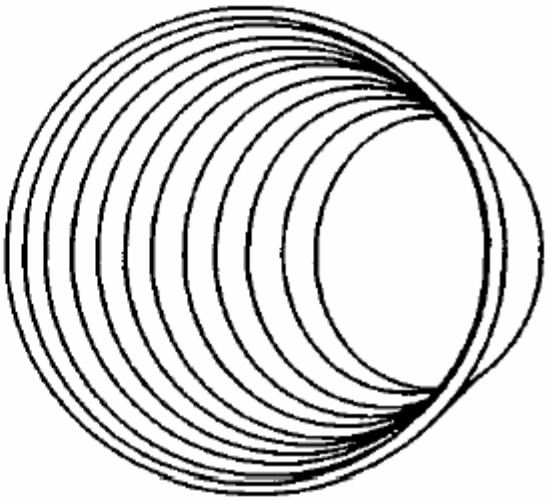
Remarks:

Appendix D

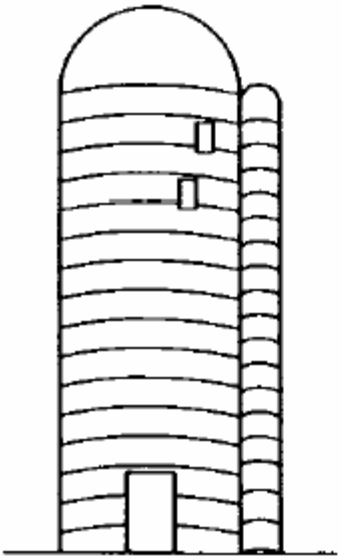
Illustrations



Storage Tank

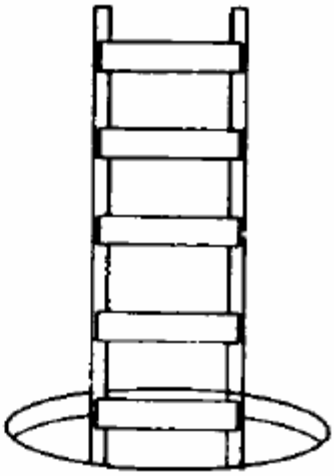


Pipeline

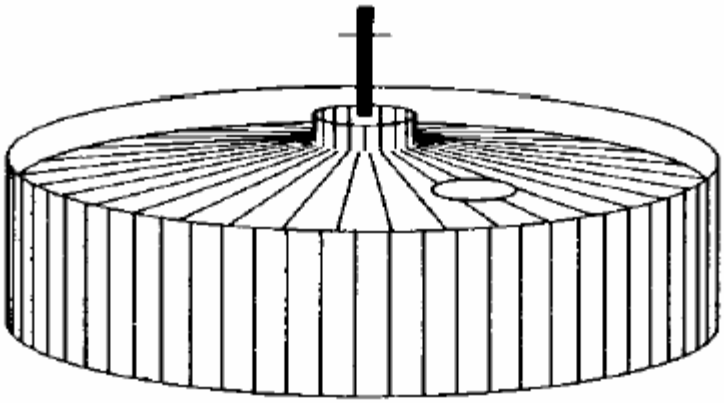


Silo

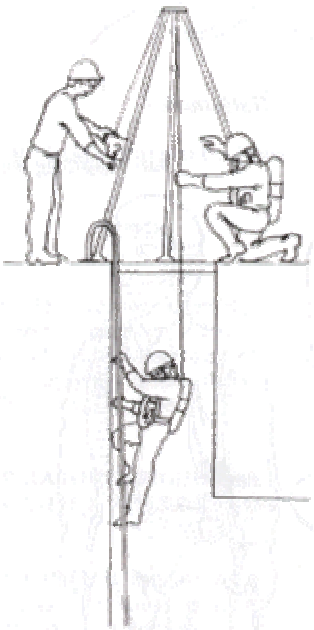
Examples of Confined Spaces



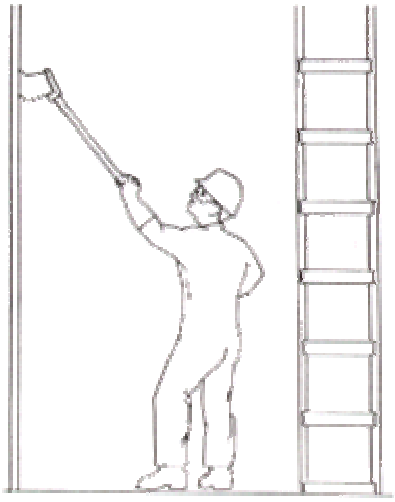
Manhole

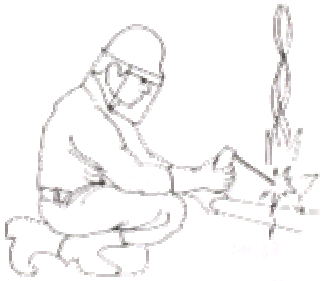


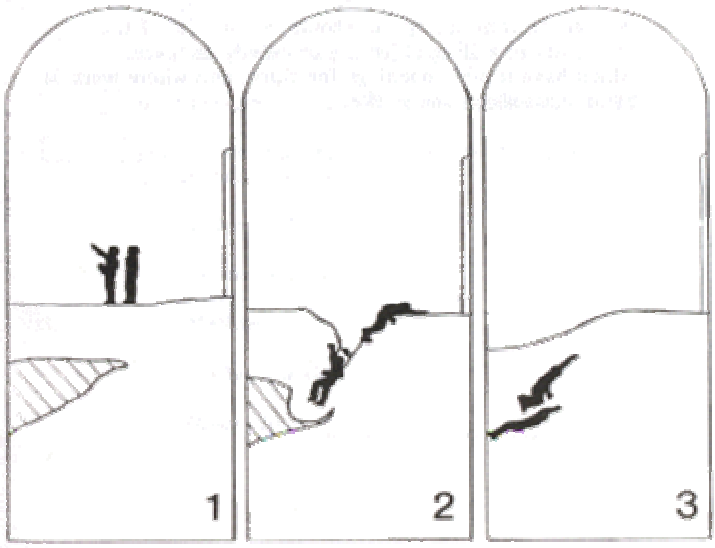
Digester



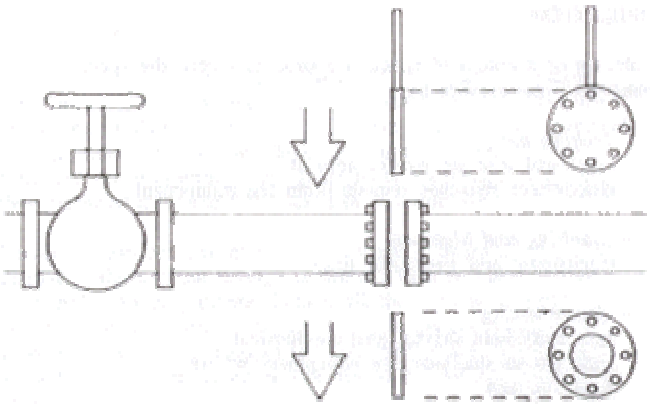
Entry with Hoist and Standby Personnel







The Hazard of Engulfment in Unstable Material



Method of Blanking Hydraulic/Pneumatic Lines