# ENVIRONMENTAL HEALTH AND SAFETY

# CONFINED SPACES PROGRAM MANUAL

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Status

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# A: INTRODUCTION

To prevent unnecessary injuries or the loss of life, the Occupational Safety and Health Administration (OSHA) enacted the Permit-Required Confined Spaces Standard (29 CFR 1910.146), effective April 15, 1993. The standard requires that all confined spaces be identified and that a written program be generated to outline procedures required for entry into those spaces.

# B: ADMINISTRATIVE ROLES

## ENVIRONMENTAL HEALTH AND SAFETY

The specific responsibility for developing and implementing Oklahoma State University (OSU) programs for health and safety resides with the Environmental Health and Safety (EHS) Department. In fulfillment of this responsibility, EHS has prepared the OSU Confined Spaces Program and assists other departments in the development and implementation of confined space procedures for their areas.

## FACILITIES MANAGEMENT

Facilities Management (FM) is a key partner in determining location and categorization of all confined spaces at OSU. FM supervisors are responsible for ensuring their employees are properly trained to do the jobs they are sent to do. This includes recognition of confined spaces and proper procedures for making entry into permit-required confined spaces whenever necessary. *No FM employee shall be sent on a job that potentially involves work in a confined space unless they have been properly trained in confined space entry procedures.*

## DEPARTMENTS

Each department is responsible for evaluating areas under its administrative control and determining whether confined spaces are present. Departments will identify confined spaces in their areas and are responsible for the implementation of the components of this Confined Spaces Program.

## MANAGERS AND SUPERVISORS

Managers and supervisors play a key role in the implementation of the Confined Spaces Program.

They are responsible for:

- Determining whether personnel need to enter confined spaces;
- Identifying personnel who will be required to participate in confined space entries as part of their duties;
- Ensuring that all personnel required to participate in confined space entries are properly trained prior to assignment;
- Ensuring that proper safety equipment required for entry is made available to personnel;
- And ensuring that all provisions of the program are followed.

## PERSONNEL

Personnel are responsible for observing all practices and procedures contained in the Confined Spaces Program, other general safety practices, attending designated training sessions, and reporting hazardous or unsafe conditions to their supervisor, the entry supervisor, or EHS. Employees designated as Authorized Entrants, Entry Supervisors, and/or Attendants are responsible for additional duties as outlined in Section G, "Duties of Designated Employees."

PROGRAM REVIEW

EHS will review the Confined Spaces Program Manual annually. Canceled permits from the previous year will be used to determine if revisions are needed to ensure employee safety. When the manual requires updating, all affected employees must be trained on the revisions.

STANDARD OPERATING PROCEDURES

Standard operating procedures (SOP) describe the method(s) that will be used to complete a task or operation. Departments with confined spaces must develop SOPs and incorporate them into this manual to complete their Confined Spaces Program.

To make the program specific to their areas, procedures must be developed for the items below:

- Training of designated employees.
- Preparation, issuance, use, and cancellation of Entry Permits.
- Conclusion of confined space entries (closing the space, debriefing).
- Communication between the Attendant and the Authorized Entrants and with rescue and emergency personnel.
- Prevention of unauthorized entry into permit-required confined spaces.
- Coordination of confined space entries with contractors.

RECORDKEEPING

The following confined space records must be maintained by each department:

- A listing of confined spaces identified by name, location, description, real or potential hazards, and classification (permit or non-permit required confined space) using the Confined Space Inventory form.
- All atmospheric testing results.
- List of employees designated to participate in confined space entries. Refer to Section H, "Training" for details.
- Monitoring equipment calibration records.
- Canceled permits for the year.

# C: IDENTIFICATION AND EVALUATION

EHS and FM shall survey each Zone to determine if confined spaces, as defined by OSHA, are present in areas under their administrative control. The confined spaces shall be identified by name, location, and description, and then evaluated by a trained team to determine if the spaces are non-permit or permit-required confined spaces. The Confined Space Inventory form, or equivalent, should be used to document this identification and evaluation process. A list of all identified confined spaces and their hazards must be maintained by EHS and FM. Upon request, EHS will assist other OSU entities in their determination of confined space categorization (permit versus non-permit required) and identification of potential and/or actual hazards present in the spaces. The OSHA Permit-Required Confined Space Decision Flow Chart shall be utilized when evaluating a new space.

*If entry is required to categorize a confined space, the entry must be conducted by following all requirements of the EHS Confined Space Entry permit system.*

A confined space is determined by the following criteria:

- Space is large enough and configured for a person to bodily enter and perform work.
- Limited or restricted means for entry and exit.
- Not designed for continuous worker occupancy.

Examples include but are not limited to sanitary sewers, well pits, boilers, manholes, sewer lift stations, tanks, silos, vessels, grain bins or dryers, storage hoppers, electrical vaults, digesters, and some excavations.

## OSU PERMIT-REQUIRED CONFINED SPACES

A permit-required confined space has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material with the potential for engulfment of an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard, including areas or processes that must be locked out and/or tagged out per the Oklahoma State University Lockout/Tagout Program.

Examples of permit-required confined spaces at OSU include but are not limited to sewers, electrical vaults, steam tunnels, sump pits, certain mechanical rooms, and some excavations.

*Any space that is accessed by lifting a manhole cover shall be considered a permit-required confined space.* Additionally, some roofs, the Lake Carl Blackwell dam access tunnel, certain grain storage facilities, and equipment access areas may be designated permit-required confined spaces even though they don't technically meet the definition (i.e., they may not really have limited or restricted means of entry or exit). *These areas shall be clearly marked as permit-required spaces.*

OSU has two blanket designations concerning permit-required confined spaces.

1. Steam tunnels, regardless of access, shall be considered permit-required confined spaces (i.e., as soon as you step into a steam tunnel, you are in a permit-required confined space, even if you walked into it through a mechanical room).

2. Attics are not considered to be permit-required confined spaces during normal daily operations. However, if maintenance operations or other work is being performed in these areas the space must be re-evaluated.

It may be determined that a space presents no real danger for employees. However, it is recommended that all spaces be considered potentially dangerous until they have been evaluated and tested. Once a space has been evaluated, EHS and FM shall determine if the confined space requires a permit and will apply appropriate labeling.

## OSU NON-PERMIT CONFINED SPACES

A Non-Permit Confined Space is a confined space that does not contain, nor has the potential to contain, any hazard capable of causing death or serious physical harm (with respect to atmospheric hazards).

Examples of non-permit required confined spaces might include the interiors of HVAC units, certain air plenums and pipe chases, attics, walk-in freezers or refrigerators, and some building crawl spaces.

## NOTIFICATION

Personnel must be made aware of the existence and location of permit-required confined spaces.

This may be accomplished by:

- The posting of danger signs reading, "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER" or other suitable language.
- Employee training on the existence and locations of permit-required spaces.
- Posting or making lists of confined spaces.
- Any other methods deemed effective by EHS and FM.

# D: NON-PERMIT REQUIRED CONFINED SPACES

GENERAL REQUIREMENTS

All confined spaces must be considered permit-required until pre-entry procedures demonstrate that hazards in the space do not exist or have been eliminated. If hazards do not exist or are eliminated, the space may be reclassified as a non-permit required confined space and entry can proceed without the use of an Entry Permit or an Attendant. Confined Spaces Entrant training is required for anyone entering non-permit spaces.

NON-PERMIT ENTRY PROCEDURES

All personnel needing to enter a non-permit confined space must:

- Inform their immediate supervisors of the confined space location and plans for entry.
- Guard or barricade entry opening to protect the safety of personnel, pedestrians, and motorists.
- Test the atmosphere prior to entry with a calibrated, direct-reading instrument for a hazardous atmosphere.
- Record monitoring results on a Monitoring Record (Confined Space Entry Permit).
- If a hazardous atmosphere is detected, the space must not be entered, and the immediate supervisor must be informed as soon as possible.
- Use continuous or periodic monitoring to alert the entrant of the unexpected development of hazardous atmospheres.
- Evaluate the space for engulfment, entrapment, or any other serious safety or health hazards. If any of these hazards are found, the space must not be entered, and a supervisor must be informed as soon as possible.
- Wear all required personal protective equipment (PPE) for the assigned task.
- Be observant of the effects of hazardous contaminants and evacuate if any are detected.
- Have a means to summon assistance (ex. cell phones, two-way radio, etc.).

# E: PERMIT-REQUIRED CONFINED SPACES

Entry into confined spaces with hazardous atmospheres, engulfment, entrapment, or other serious hazards must be performed under permit-required confined space entry procedures. Entry must be performed under a permit issued by a designated Entry Supervisor. A minimum of one Attendant must be stationed outside the permit space for the duration of the entry. Before entry, several pre-entry procedures must be followed, including but not limited to, isolation of the permit space, removal or control of atmospheric hazards, barricading space entrances, and verifying that acceptable conditions are maintained throughout the entry.

Space specific entry procedures should be reviewed in a pre-planning meeting. Permit space entry procedures must be conducted as outlined in the departmental SOPs and entry permit and must include a debriefing of personnel involved in the entry when the task has been concluded.

PRE-PLANNING

A pre-planning meeting must be conducted to ensure that all parties know the work to be done, pre-entry procedures, duties of each team member, hazards that may be encountered, equipment necessary and emergency plans. Pre-planning must take place between all parties involved in permit-required confined space entries. This meeting serves the purpose of reviewing entry procedures as well as covering specific hazards inherent to the spaces being entered. Work procedures involving any chemicals or work techniques which

could create additional hazards within the space should also be covered. The Entry Planning Worksheet can assist in gathering all the data needed.

Pre-planning must cover all required engineering controls needed to address the space's hazards, including ventilation, space isolation, lockout/tagout of equipment or processes, and PPE. Finally, emergency response and rescue procedures must be reviewed.

## ENTRY PERMIT

The Entry Permit is the item that documents program compliance and authorizes entry to a permit-required confined space. The designated Entry Supervisor is responsible for issuing the permit before beginning the entry process. Permits are authorized for one day or for the duration of the required task. Entry Permits must be posted at the work site for the duration of entry to allow for the documentation of atmospheric testing results and verification of acceptable conditions. Problems encountered during entry must be noted on the permit so revisions to the entry procedures can be made.

The Entry Supervisor must cancel the permit when pre-entry operations have not been completed or if conditions arise that prevent entry such as conditions outlined in the permit change; conditions not allowed under the Entry Permit occur in or near the permit space; or the work has been completed. Cancelled permits must be retained for a minimum of one year for program review purposes.

Each department shall establish procedures for the preparation, issuance, use, and cancellation of Entry Permits. Departments should use the Confined Spaces Entry Permit, developed by EHS.

## ENTRY PROCEDURES

All personnel needing to enter a permit-required confined space must:

- Obtain or prepare a Confined Spaces Entry Permit.
- Notify Stillwater Fire Department the day of the entry, including time and location of the space.
- Gather necessary tools and equipment to complete the required task.
- Gather necessary PPE to complete the required task.
- Conduct pre-planning meeting.
- Guard or barricade the entry opening.
- Isolate the permit space.
- Test the atmospheric conditions in the space at multiple levels. Note results on the Monitoring Record on the Confined Spaces Entry Permit.
- Ventilate if indicated by monitoring. Ensure that a minimum of seven air changes are achieved, then re-test atmospheric conditions. STOP the entry and notify your supervisor if hazardous atmospheres are not brought within acceptable conditions by ventilation.
- Evaluate the space for engulfment, entrapment or any other serious safety or health hazards. If any of these hazards are found, attempt to control them using lockout/tagout or other suitable control measures. STOP the entry and notify your supervisor if the hazards cannot be controlled.
- Verify that acceptable conditions have been achieved on the Monitoring Record located on the Confined Spaces Entry Permit.
- Begin the permit entry and perform necessary work.
- Always maintain contact between entrants and Attendant during the entry to ensure safety.
- Use continuous atmospheric testing and/or continuous ventilation with periodic atmospheric testing to guard against the development of hazardous atmospheres.
- Evacuate the space and take corrective measures if any prohibited condition develops during entry (i.e., monitor alarm, hazards in or out of the space develop, symptoms of exposure experienced by entrant or observed by Attendant, etc.). STOP the entry and notify your supervisor if acceptable conditions cannot be reestablished.
- Conclude work in the space by removing tools and restoring function to all systems in the space.

- Evacuate the space, close all entrances, and remove barricade equipment.
- Conduct a post entry debriefing with all personnel involved in the entry.
- Return Entry Permit to Entry Supervisor for cancellation and retain documents for a minimum of one year.

# F: CONTRACTORS

Contractors working at Oklahoma State University in or near permit-required confined spaces shall be informed of and follow the contractor-specific items listed below:

- Contractors must be informed about the Oklahoma State University Confined Spaces Program and its requirements;
    - Known hazards or potential hazards present in the space;
    - Recommended safety precautions needed for the space;
    - Coordination needed for entry operations;
    - And times when Oklahoma State University personnel will enter or work near the confined space.
- Contractors must submit a copy of their confined space entry program to EHS and FM.
- Contractors must be debriefed upon exit.
- Contractors entering confined spaces must inform EHS or FM of the confined space procedures used during entry and hazards encountered or created in the confined space.

It is recommended that the Contractor Confined Space Entry Notification form be used as documentation.

# G: DUTIES OF DESIGNATED EMPLOYEES

The training and assigning of Entry Supervisors, Authorized Entrants, and Attendants (and each role subsequent responsibilities) must be included in the department's SOPs for confined space entry.

ENTRY SUPERVISOR
Entry Supervisors are primarily responsible for ordering entries into permit-required spaces and ensuring all proper procedures contained in this manual are followed.

In addition, Entry Supervisors are responsible for:

- Knowing the hazards that may be faced during entry, including signs, symptoms, and consequences of exposure.
- Conducting pre-planning meetings with designated personnel involved in permit-required confined space entries.
- Completing a Confined Space Entry Permit.
- Verifying that all Confined Space Entry Permit requirements have been properly addressed before entry.
- Authorizing entry by signing Confined Space Entry Permit.
- Verifying that rescue services are available and can be summoned.
- Removing unauthorized individuals from the entry area.
- Canceling the permit if unacceptable conditions arise during entry or if assigned work has been completed.
- Ensuring that the terms of the Confined Space Entry Permit are followed and that acceptable entry conditions are maintained.

AUTHORIZED ENTRANT
Authorized Entrants are those entering the permit-required spaces and performing necessary duties.

Authorized Entrants are responsible for:

- Knowing the hazards that may be encountered during entry including information on the signs, symptoms, or consequences of exposure.
- Knowing the proper use of equipment required for entry including monitoring, ventilation, PPE and lighting equipment, barriers/shields, safety equipment for entry and egress, and rescue and emergency equipment.
- Communicating with the Attendant.
- Alerting Attendant if warning signs or symptoms of exposure are detected, or if a prohibited condition occurs.
- Exiting the space if the Attendant orders evacuation, warning signs or symptoms of exposure are detected, a prohibited condition occurs, or if an evacuation alarm is activated.

ATTENDANT
Attendants are individuals who are stationed outside permit-required spaces to monitor Authorized Entrants, as well as perform required duties.

Specifically, Attendants are responsible for:

- Knowing the hazards that may be encountered during entry, including information on the signs, symptoms, or consequences of exposure.
- Knowing behavioral effects of hazard exposure, such as those from heat or chemical exposure. Example effects include slurred speech and/or physical impairment.
- Maintaining an accurate count of Entrants and ensuring the permit correctly identifies exactly who is in the space.
- Remaining outside the permit space during entry until relieved by another Attendant.
- Communicating with Entrants to monitor status and alert them of the need to evacuate the space.
- Monitoring activities inside and outside the space to identify potential hazards to the Entrants and call for evacuation if conditions are unsafe. (i.e., prohibited condition is detected, behavioral effects of hazard exposures to Authorized Entrants are detected, and conditions outside the confined space change such that Authorized Entrants are endangered, or the Attendant cannot perform all duties required).
- Monitoring multiple confined space entries and performing other duties as long as the spaces are in close proximity and other duties performed are in the immediate vicinity of the spaces. However, the safety of the Authorized Entrant must be the first priority.
- Summoning rescue and other emergency services as soon as it is determined that the Entrants may need assistance to escape.
- Removing or preventing unauthorized personnel from entering the permitted space.
- Performing non-entry rescues.

*The Attendant shall not enter the confined space.*

# H: TRAINING

EHS will provide training so all personnel whose work involves confined space entries become proficient in the requirements of this program. All personnel must gain the understanding, knowledge, and skills necessary for the safe performance of their assigned duties. OSU Confined Space Entrant training is required for all personnel prior to participating in any confined space entries. Training applies to all personnel involved in confined space work, including authorized entrants, attendants, entry supervisors and rescue personnel.

Retraining must be provided when the following occurs:

- Before there is a change in assigned duties.
- Whenever there has been a change in permit space operations that presents a hazard previous training did not cover.
- Whenever there are deviations from the permit space entry procedures required by the Entry Permit.
- When there are inadequacies in personnel knowledge or use of required procedures.

Each training program shall be evaluated annually to ensure effectiveness and accuracy. Please use the Confined Space Training Checklist to assist with this review.

# I: REQUIRED EQUIPMENT

Various safety equipment items are required to ensure safe entries into and rescues from permit-required confined spaces. These items must be supplied at no charge to employees engaged in permit space entries. The extent of actual equipment required will depend on hazards present and the category of the confined space being entered. Training must include hands-on usage of all required equipment to such an extent that personnel become proficient in their understanding and use of the equipment.

Possible equipment includes:

- Ventilation fan(s).
- Lifelines.
- Retrieval equipment.
- PPE.
- Monitoring equipment (See Section I. Atmospheric Testing below).
- Lighting equipment.
- Communication equipment.
- Lockout/Tagout devices.
- Barricade equipment.
- Other safety equipment required to complete the job.

Retrieval systems or methods must meet the following requirements:

- Authorized Entrants entering permit-required confined spaces must wear a safety harness attached to retrieval equipment located outside the permit space by way of a retrieval line. Wristlets may only be used in lieu of chest or full body harnesses if it can be demonstrated that the harness usage creates a greater hazard and wristlets are the safest and most effective alternative.
- Retrieval lines must be attached to a mechanical device or fixed point outside the permit space so rescue can begin as soon as it becomes necessary.
- A retrieval hoist must be available to retrieve personnel working in vertical-type confined spaces deeper than 5 feet.

*When respirators or lockout/tagout procedures are required to enter a confined space, training must be provided to all affected personnel within the requirements of each specific regulation.*

# J: ATMOSPHERIC TESTING

Atmospheric testing is required for the evaluation of hazards during initial classification and upon each subsequent entry into a confined space. At a minimum, the space must be tested for oxygen, combustible gases and vapors, and toxic gases and vapors. These items can be tested individually (oxygen first,

combustibles, then toxics) or they can be tested simultaneously. All testing must be recorded on either the Confined Spaces Inventory or on the Monitoring Record on the Confined Spaces Entry Permit.

- Testing for atmospheric hazards must be conducted prior to entry into all confined spaces to determine if acceptable entry conditions exist.
- The atmosphere must be tested at various levels in the confined space. Atmospheric hazards may be found at different levels, depending on the contaminants present and the conditions of the space.
- During entry into the space, monitoring must be continuous to ensure that acceptable entry conditions are maintained.
- Continuous atmospheric testing must be used when the risk of the development of hazardous atmospheres is high.
- If the monitoring instrument goes into alarm or fails to operate at any time during entry, the entry must be stopped, and Entrants removed from the space.

Monitoring equipment must be maintained according to manufacturers' specifications to ensure proper operation during confined space testing and entry. Instrument calibration to known gas concentrations must be conducted prior to instrument use in a confined space entry to ensure equipment operation is within acceptable ranges.

Proper atmospheric testing will be one of the most important subjects covered in employee training. Employees must become familiar with the performance and limitations of their monitoring equipment. EHS can assist departments with the proper selection and usage of personal monitoring equipment for confined space testing and entry.

MINIMUM CONDITIONS FOR ENTRY

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|---|---|---|---|
| Oxygen | Between 19.5%- | Flammable dusts | Visibility > 5 ft. |
| Flammable gasses | < 10% of LEL | Engulfment hazards | None present |
| Hydrogen sulfide (H2S) | < 10 ppm | Hazardous flows | Secured and locked/tagged |
| Carbon monoxide (CO) | < 35 ppm | Hazardous energies | Secured and locked/tagged |
| Other toxic substances | < PEL for substance | External hazards | Controlled |

*If conditions are not met, entry is prohibited. If occupied, the space must be immediately evacuated.*

# K: EMERGENCY RESPONSE AND RESCUE

Oklahoma State University will rely on rescue personnel from the City of Stillwater Fire Department in the event of an emergency during a confined space entry. To facilitate non-entry rescue, rescue retrieval systems (harnesses, ropes, etc.) must be used by Authorized Entrants unless use of those systems would result in an increase of overall risk of entry or would not contribute to the rescue of Authorized Entrants. External retrieval should be attempted only after emergency rescue personnel have been summoned.

# L: DIRECTORY

Environmental Health and Safety

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University Health Services

1202 West Farm Road / (405) 744-7665

Facilities Management

402 North Willis / (405) 744-7154

# APPENDIX A: DEFINITIONS

Attendant: A person designated by the department head in charge of entry to remain outside the confined space and to be in constant communication with the personnel working inside the confined space.

Authorized Entrant: Person who is approved or assigned by the department head in charge of the entry to perform a specific type of duty or duties or to be at a specific location at the job site.

Confined Space: A space which is:

- Large enough and so configured for an employee to bodily enter and perform work.
- Limited or restricted means for entry and exit.
- Not designed for continuous worker occupancy.

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

Entry Permit: The written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in this program.

Entry Supervisor: The designated representative (such as the foreman or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this program.

Hazardous Atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, and 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 causes:

- Flammable atmosphere.
- Airborne combustible dust.
- An atmosphere containing oxygen levels below 19.5% or above 23.5%
- An atmosphere where the permissible exposure limit for a certain chemical has been exceeded and could result in exposure
- Any other atmospheric condition that is immediately dangerous to life and health

Hot Work: Any work involving burning, welding, or similar fire-producing operations. Example - work that produces a source of ignition, such as grinding, drilling, or heating.

Hot Work Permit: The employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Lower Explosive Limit: The minimum concentration of a combustible gas or vapor in air that will ignite if an ignition source is introduced.

Non-Permit Required Confined Space: A confined space NOT containing ANY of the characteristics listed under permit-required confined spaces may be considered a non-permit confined space.

Oxygen-Deficient Atmosphere: Atmosphere that contains an oxygen concentration less than 19.5% by volume.

Oxygen-Enriched Atmosphere: Atmosphere that contains an oxygen concentration greater than 23.5% by volume.

Permissible Exposure Level: Concentration of a substance to which an individual may be exposed repeatedly without adverse effect.

Personal Protective Equipment: A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Permit-Required Confined Space: A confined space which has one or more of the following characteristics:

- May contain or has the potential to contain a hazardous atmosphere.
- May contain a material with the potential for engulfment of an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard, including areas or processes that must be locked out and/or tagged out per the Oklahoma State University Lockout/Tagout Program.
- Must be identified by the employer (or contractor) who must inform exposed employees of the existence and location of such spaces and their hazards.