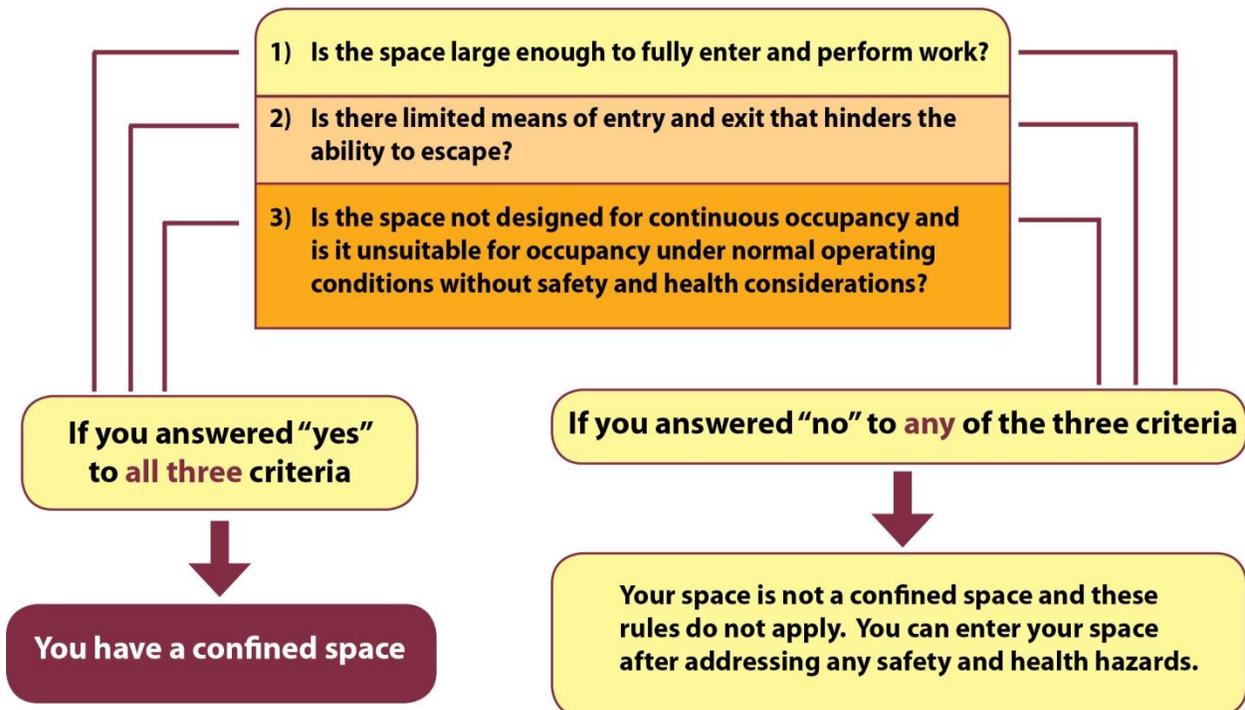


OAR 437-002-0146 Confined Spaces

Non-Mandatory Appendices A, B, C, and D for OAR 437-002-146 Confined Spaces

Non-Mandatory Appendix A Part I: Evaluate the space to determine if you have a confined space.

Evaluate the Space



Evaluation of confined spaces

A confined space is defined as having **three** distinct characteristics. It must meet all three in order to be a confined space.

1 – It must be large enough to enter.

First, it must be large enough and so configured that an employee can fully enter and perform work. A space that is just large enough that an employee could just barely squeeze into, but cannot perform any work does not meet this definition. Similarly, a space that is large enough that an employee can only get part of their body into, but can't fully enter, does not meet this definition. While there may be hazards associated with these types of spaces, they are not addressed with this particular rule.

2 – It must have limited means of entry and exit.

Second, it must have a limited means for entry and exit. Typically, if you must contort your body to enter a space it may be limited means of entry and exit. Examples of this include having to climb through a porthole, climb up a ladder, or crawling through a tunnel in order to exit.

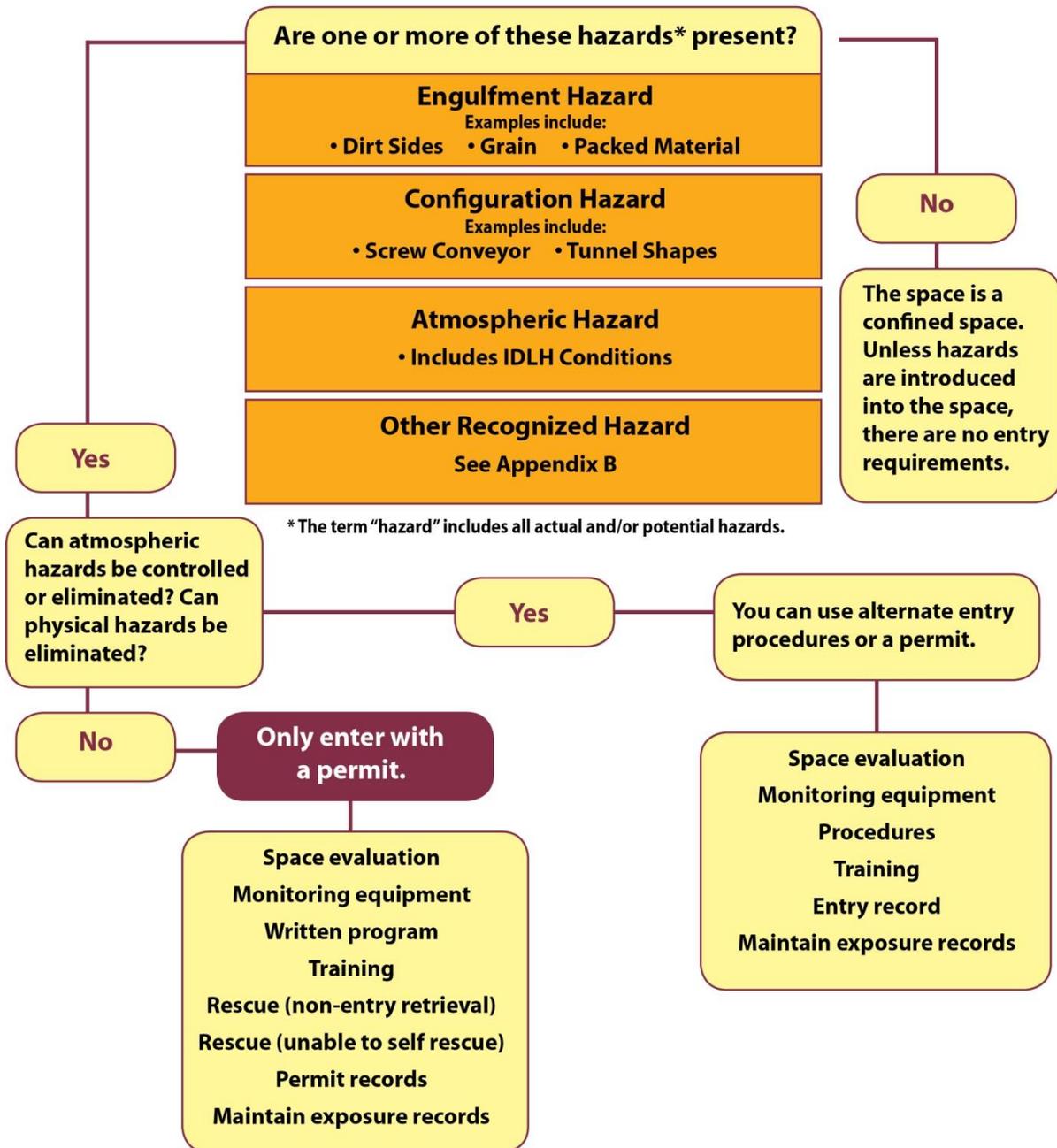
Another way of measuring limited means of entry and exit is to determine how difficult it would be to extract an injured person from the space. If there is a need for any type of technical rescue operation to remove an immobilized person from the space then you likely have limited entry and exit. It is important to recognize that each space should be evaluated on a case by case basis and a limitation in one set of circumstances may not be a limitation elsewhere.

3 – It is not designed for continuous occupancy.

Third, it is not designed for continuous human occupancy. This particular characteristic can cause a certain amount of confusion and discussion. A space that is designed for periodic occupancy is not the same thing as a space that is designed for continuous occupancy. The presence of a fixed ladder, lighting, or ventilation does not automatically mean that the space was designed for continuous occupancy. One must look at the primary function and purpose of the space. A space may have lighting to facilitate periodic occupancy. This lighting may be needed to safely enter and exit, read gauges or perform maintenance or repairs to equipment in the space. Similarly, ventilation may be necessary to keep equipment from overheating or provide fresh air for temporary job assignments or tasks. In both cases the work required to be performed in these spaces is intermittent or temporary in nature. Was the space designed for an employee to be permanently assigned to perform work there or was the space designed to house and protect operating equipment that needs to be monitored or occasionally maintained?

PART II: Determine if you have a permit-required confined space.

You determined that you have a confined space.



Evaluation of Permit-Required Confined Spaces

A permit space is a confined space with an actual or potential hazard that can inhibit an entrant's ability to safely exit the space.

Once a confined space is identified, the next step is to determine if it is a permit-required confined space (permit space). There are 2 types of actual or potential hazards.

Atmospheric hazards can include an oxygen-deficient or oxygen-rich atmosphere, a toxic atmosphere, or an explosive atmosphere. Physical hazards can include entrapment, engulfment, electrocution, heat stroke, moving machinery, or any other serious hazard.

Atmospheric Hazards:

In evaluating the atmospheric hazards, it is important to include conditions within the space, systems connected to the space, conditions outside of the space, and anything that is brought into the space in order to perform assigned tasks. For example, workers may need to enter one part of a tunnel where there are no obvious sources of atmospheric hazards, but workers in another part of the tunnel may be creating an atmospheric hazard that has the potential to migrate to other parts of the system. These need to be identified by all affected parties. Another example of overlooked hazards can be with a space with a particularly small volume with several workers inside. In these situations the simple act of breathing can create an oxygen-deficient atmosphere.

Another consideration for evaluating atmospheric hazards is using air monitoring equipment to evaluate conditions within a permit space. Any air monitoring equipment must be used according to the manufacturer's instructions, and employees using those meters must know how to use them. There have been several fatalities in permit required confined spaces where the air monitoring equipment alarms identified an unsafe condition but were ignored by the operator. If there is any indication of equipment failure all permit required confined space operations must stop until the equipment is repaired.

Also, there can be a tendency to oversimplify the results of oxygen testing when evaluating an oxygen-deficient atmosphere. While the rule clearly identifies 19.5% as an oxygen-deficient atmosphere; that does not mean that nothing more needs to happen if the meter reads 19.6% oxygen. Typically, the normal atmospheric concentration of oxygen is around 20.8% to 21.5%. If your meter reads 20.9% outside of the space, and 19.9% inside the space that is telling you that something has displaced 1% of the oxygen inside the space, which can equate to at least 10,000 parts-per-million of another gas. To put this into perspective, an atmosphere containing 1200 parts-per-million of carbon monoxide is considered to be immediately dangerous to life and health. It is vitally important to identify that other gas to adequately identify all of the hazards of that space.

Physical Hazards:

Physical hazards can come in many different forms. The hazard could be related to the configuration of a space, equipment inside the space or materials which can flow into a space and entrap an entrant. There are several ways of eliminating physical hazards through lockout/tagout, blanking and blinding or a physical separation on piping systems from the confined space.

In evaluating physical hazards, it is important to understand that the confined space must be evaluated as it normally operates. There can be a tendency to evaluate a space after protective actions, such as lockout/tagout, are taken, and then not designate it as a permit space. If any actions, such as lockout/tagout, are necessary to make the space safe for entry, then it is a permit space. While lockout/tagout is recognized as an elimination of hazards, it is only a temporary elimination that exists only as long as the lock is in place. Once the lock is removed, the hazard is no longer eliminated. Another consideration for using lockout/tagout is that all of the requirements for the control of hazardous energy in 1910.147, where applicable, still apply. Any hazards that still remain after applying lockout/tagout must still be addressed.

Non-Mandatory Appendix B

Potential Confined Space Hazards

What follows is a compilation of hazards and conditions which may compromise safe confined space entry and/or rescue procedures. The list is not exhaustive. Specific confined spaces may have hazards unique to that space. All hazards need to be evaluated and eliminated or controlled prior to entry. Consider hazards that may be present initially as well as those that may develop during the course of work.

Atmospheric hazards:

- Oxygen deficiency
- Oxygen enrichment
- Inert gases used to exclude oxygen (for example, nitrogen, helium, steam, freons, argon, or carbon dioxide)
- Flammable or explosive gases, liquids, vapors, mists, fibers, or dusts
- Toxic dusts, mists, fumes, smoke, vapors, fibers, or gases
- Airborne biological contaminants, including molds, bacteria, viruses and other potential disease-inducing agents

Engulfment hazards – presence of materials that can capture or surround an entrant:

- Avalanche of materials
- Surrounding and suffocating
- Trenching cave-ins
- Drowning
- Bridged materials which collapse when stepped on

Falls from heights

Falling objects (tools, structural materials, debris)

Harness or lifeline snag points (e.g., agitator blades, piping, screws, etc.)

Configuration of space:

- Complexity of internal structure
- Inwardly sloping walls or floors
- Tight and/or narrow diameter spaces – entrapment
- Access restricting rescue

Ignition sources – examples include:

- Grinding
- Welding, cutting, burning, brazing
- Space heaters
- Hand tools
- Power tools
- Exposed light bulbs
- Sources of static electric discharge (e.g., synthetic clothing, transfer of liquids or gases not bonded and grounded)
- Non-intrinsically safe equipment

Illumination – insufficient in quality or quantity

Moving mechanical equipment:

- Agitators
- Tumblers
- Crushers
- Mixing blades
- Screw conveyors
- Shakers

Electrical power sources

- Transmission lines
- Junction boxes
- Transformers
- Electrically powered equipment taken into the space or installed in the space

Hydraulically or pneumatically powered equipment

Pressurized lines

- Steam
- Hydraulic
- Pneumatic
- Fuel and other gas
- Water

Radiation

- Ionizing
- Non-ionizing (including lasers)

Process material lines, open or leaking lines which introduce:

- Toxic materials
- Flammable or combustible
- Oxidizing materials
- Corrosive materials
- Heated liquid or gaseous substances (such as steam) containing hydraulic oils, other fluids, or gases
- Other substances hazardous to health or that may displace oxygen

Isolation is difficult or impossible – Examples of environments in which significant isolation issues may arise:

- Wastewater sewer systems
- Stormwater drain systems
- Dams
- Hydro-electric plants
- Nuclear plants

Hazards originating in adjacent areas:

- Exhaust or flue gases
- Chemical releases

Mobile confined spaces that are not adequately secured prior to entry:

- Moving (such as ships and barges; or rail cars or tank trucks that do not have chocks or wheel blocks)
- Rotating (cement or other trucks which may not be properly locked out)

- Shifting (tank trucks lacking a cab or jack stand)
- Crushing (garbage trucks which may not be properly locked out)

Noise (preventing the ability to communicate or hear warnings)

Slippery surfaces

Surface contaminants – liquids and solids on floors, walls, ceilings, or other interior surfaces that may cause eye or skin irritation, burns, or other adverse health effects upon contact

Thermal (heat and cold) extremes:

- Surfaces (radiant or conduction)
- Air temperature (convection)

Tripping hazards

Uncontrolled lateral movement or swing potential with suspended loads

Vibration – Vibrating equipment or vibration of the confined space

Work or equipment introducing additional hazards:

- Hot work (welding, cutting, burning, grinding)
- Inerting
- Abrasive blasting
- Surface coating and painting
- Use of solvents, degreasers, and other cleaning agents
- Demolition activities
- Use of internal combustion engines
- Use of space heaters
- Use of equipment which is not approved or fit for use in the type of confined space, such as non-intrinsically safe or no GFCI when needed.

Non-mandatory Appendix C Sample Confined Space Entry Permit and Alternate Entry Form

The following confined space entry permit and alternate entry form can be modified to fit your particular entry. Make sure you use only the appropriate portions of the forms to create your own entry permit or alternate entry form.

You can also design your own entry permit or alternate entry form. You're **not** required to use the examples provided here.

SAMPLE CONFINED SPACE ENTRY PERMIT

Permit

date: / / **Work shift:** 1st 2nd 3rd **Expires:** / /

Time started:

Permit space to be entered (name and location of space):

Purpose of entry:

Pre-entry checklist

Do not enter this permit space until the following “needs action” conditions are corrected.

OK	Needs action	
<input type="checkbox"/>	<input type="checkbox"/>	Before entering the permit space, the supervisor or designee must notify the rescue team. IDLH conditions require at least one rescue team member located outside the space.
<input type="checkbox"/>	<input type="checkbox"/>	A minimum of two employees must be assigned to work involving permit space entry. One employee must remain outside the permit space at all times.
<input type="checkbox"/>	<input type="checkbox"/>	The surrounding area must be surveyed to show that it is free of hazards such as drifting vapors from tanks, piping, sewers, or vehicle exhaust.
<input type="checkbox"/>	<input type="checkbox"/>	Those responsible for operation of the gas monitor have been trained.
<input type="checkbox"/>	<input type="checkbox"/>	Gas monitor calibration tests and functional test (fresh air calibration) have been performed this shift on the gas monitor.
<input type="checkbox"/>	<input type="checkbox"/>	The atmosphere will be continuously monitored while the space is occupied, if required by entry procedure.

Identify potential hazards

Possible atmospheric hazards	Yes	No	N/A
Lack of oxygen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible gases	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible vapors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Combustible dusts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Toxic gases/vapors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Possible non-atmospheric hazards			
Noise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chemical contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electrical hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical exposure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Temperature extreme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engulfment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Entrapment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other non-atmospheric hazard (list on separate page)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Pre-entry requirements

Requirements	Yes	No	N/A	Requirements	Yes	No	N/A
Lockout - tagout/de-energize	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hot work permit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pipes(s) broken or capped or blanked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fall arrest harness/lifeline/tripod	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Purge or flush or drain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Personal protective equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation (natural or mechanical)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hardhat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Secure area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Gloves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Safe lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Safety glasses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-sparking tools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Respirator, type	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication method	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other PPE:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contractor employees involved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other PPE:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Continuous air monitoring used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Periodic air monitoring used	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Space-monitoring results		Test 1	Test 2	Test 3	Test 4
Substance monitored	Permissible entry levels	Time: Initial:	Time: Initial:	Time: Initial:	Time: Initial:
Percent oxygen	19.5% to 23.5%				
Combustible gas	Less than 10% LEL				
Other toxic gas					
Other toxic gas					
Other toxic gas					

Names of trained, authorized individuals

- Entry supervisor: _____
- Entry attendant: _____
- Authorized entrants: _____
- Authorized entrants: _____

Emergency contact information

Emergency responder: _____ Phone number: _____
 Contact person: _____ Time: _____

This permit has been terminated for the following reason:

Work completed Canceled Time: _____ Note: _____

Supervisor's signature _____ Time: _____ Date: / /

Return this completed permit to _____ . Review, then file for one year.

SAMPLE ALTERNATE ENTRY FORM

Location of space:	
Entry date:	Duration of entry:

List entrants' names

List physical hazards in the space	List atmospheric hazards in the space

List each action taken to eliminate physical and atmospheric hazards in the space	
Action	Description

Ventilation	
Is ventilation required? YES <input type="checkbox"/>	NO <input type="checkbox"/>
If "Yes," type of ventilation:	Amount of ventilation (cfm or AC/hr)

Air monitoring					
Substance monitored	Unit	Permissible levels		Monitoring results	
				Initial Test	Peak reading during entry

Instruments used for air monitoring	
Model # or type:	Calibration (or bump test) date:

Additional notes about the space and entry (including whether evacuation was necessary)

Person responsible for ensuring the space is safe to enter	
Name:	Job title:
Signature:	

Non-Mandatory Appendix D

Rescue Service Considerations

- (1) This appendix provides guidance to employers in choosing an appropriate rescue service. It contains criteria that may be used to evaluate the capabilities both of prospective and current rescue teams. Before a rescue team can be trained or chosen, however, a satisfactory permit program, including an analysis of all permit-required confined spaces to identify all potential hazards in those spaces, must be completed. Oregon OSHA believes that compliance with all the provisions of 437-002-0146 will enable employers to conduct permit space operations without recourse to rescue services in nearly all cases. However, experience indicates that circumstances will arise where entrants will need to be rescued from permit spaces. It is therefore important for employers to select rescue services or teams, either on-site or off-site that are equipped and capable of minimizing harm to both entrants and rescuers if the need arises.
- (2) For all rescue teams or services, the employer's evaluation should consist of two components: an initial evaluation, in which employers decide whether a potential rescue service or team is adequately trained and equipped to perform permit space rescues of the kind needed at the facility and whether such rescuers can respond in a timely manner, and a performance evaluation, in which employers measure the performance of the team or service during an actual or practice rescue. For example, based on the initial evaluation, an employer may determine that maintaining an on-site rescue team will be more expensive than obtaining the services of an off-site team, without being significantly more effective, and decide to hire a rescue service. During a performance evaluation, the employer could decide, after observing the rescue service perform a practice rescue, that the service's training or preparedness was not adequate to effect a timely or effective rescue at his or her facility and decide to select another rescue service, or to form an internal rescue team.

a. Initial Evaluation

- i. The employer should meet with the prospective rescue service to facilitate the evaluations required by 437-002-0146(9). At a minimum, if an off-site rescue service is being considered, the employer must contact the service to plan and coordinate the evaluations required by the standard. Merely posting the service's number or planning to rely on the 911 emergency phone number to obtain these services at the time of a permit space emergency would not comply with the rescue requirements of the standard.
 1. The capabilities required of a rescue service vary with the type of permit spaces from which rescue may be necessary and the hazards likely to be encountered in those spaces. Answering the questions below will assist employers in determining whether the rescue service is capable of performing rescues in the permit spaces present at the employer's workplace. What are the needs of the employer with regard to response time

(time for the rescue service to receive notification, arrive at the scene, and set up and be ready for entry)? For example, if entry is to be made into an IDLH atmosphere, or into a space that can quickly develop an IDLH atmosphere (if ventilation fails or for other reasons), the rescue team or service would need to be standing by at the permit space. On the other hand, if the danger to entrants is restricted to mechanical hazards that would cause injuries (e.g., broken bones, abrasions) a response time of 10 or 15 minutes might be adequate.

2. How quickly can the rescue team or service get from its location to the permit spaces from which rescue may be necessary? Relevant factors to consider would include: the location of the rescue team or service relative to the employer's workplace, the quality of roads and highways to be traveled, potential bottlenecks or traffic congestion that might be encountered in transit, the reliability of the rescuer's vehicles, and the training and skill of its drivers.
3. What is the availability of the rescue service? Is it unavailable at certain times of the day or in certain situations? What is the likelihood that key personnel of the rescue service might be unavailable at times? If the rescue service becomes unavailable while an entry is underway, does it have the capability of notifying the employer so that the employer can instruct the attendant to abort the entry immediately?
4. Does the rescue service meet all the rescue requirements of the standard? If not, has it developed a plan that will enable it to meet those requirements in the future? If so, how soon can the plan be implemented?
5. For off-site services, is the service willing to perform rescues at the employer's workplace? (An employer may not rely on a rescuer who declines, for whatever reason, to provide rescue services.)
6. Is an adequate method for communications between the attendant, employer and prospective rescuer available so that a rescue request can be transmitted to the rescuer without delay? How soon after notification can a prospective rescuer dispatch a rescue team to the entry site?

7. For rescues into spaces that may pose significant atmospheric hazards and from which rescue entry, patient packaging and retrieval cannot be safely accomplished in a relatively short time (15-20 minutes), employers should consider using airline respirators (with escape bottles) for the rescuers and to supply rescue air to the patient.
8. If the employer decides to use SCBA, does the prospective rescue service have an ample supply of replacement cylinders and procedures for rescuers to enter and exit (or be retrieved) well within the SCBA's air supply limits?
9. If the space has a vertical entry over 5 feet in depth, can the prospective rescue service properly perform entry rescues? Does the service have the technical knowledge and equipment to perform rope work or elevated rescue, if needed?
10. Does the rescue service have the necessary skills in medical evaluation, patient packaging and emergency response? Where necessary, can the rescue service perform patient decontamination before being transported to a medical facility?
11. Does the rescue service have the necessary equipment to perform rescues, or must the equipment be provided by the employer or another source?

b. Performance Evaluation

Rescue services are required by paragraph (9)(d) of the standard to practice rescues prior to an entry or within 12 months of an entry, provided that the team or service has not successfully performed a permit space rescue within that time. As part of each practice session, the service should perform a critique of the practice rescue, or have another qualified party perform the critique, so that deficiencies in procedures, equipment, training, or number of personnel can be identified and corrected. The results of the critique, and the corrections made to respond to the deficiencies identified, should be given to the employer to enable it to determine whether the rescue service can quickly be upgraded to meet the employer's rescue needs or whether another service must be selected. The following questions will assist employers and rescue teams and services evaluate their performance.

- i. Have all members of the service been trained as permit space entrants, at a minimum, including training in the potential hazards of all permit spaces, or of representative permit spaces, from which rescue may be needed? Can team members recognize the signs, symptoms, and consequences of exposure to any hazardous atmospheres that may be present in those permit spaces?

- ii. Is every team member provided with, and properly trained in, the use and need for PPE, such as SCBA or fall arrest equipment, which may be required to perform permit space rescues in the facility? Is every team member properly trained to perform his or her functions and make rescues, and to use any rescue equipment, such as ropes and backboards, that may be needed in a rescue attempt?
- iii. Are team members trained in the first aid and medical skills needed to treat victims overcome or injured by the types of hazards that may be encountered in the permit spaces at the facility?
- iv. Do all team members perform their functions safely and efficiently? Do rescue service personnel focus on their own safety before considering the safety of the victim?
- v. If necessary, can the rescue service properly test the atmosphere to determine if it is IDLH?
- vi. Can the rescue personnel identify information pertinent to the rescue from entry permits, hot work permits, and SDSs?
- vii. Has the rescue service been informed of any hazards to personnel that may arise from outside the space, such as those that may be caused by future work near the space?
- viii. If necessary, can the rescue service properly package and retrieve victims from a permit space that has a limited size opening (less than 24 inches (60.9 cm) in diameter), limited internal space, or internal obstacles or hazards?
- ix. If necessary, can the rescue service safely perform an elevated (high angle) rescue?
- x. Does the rescue service have a plan for each of the kinds of permit space rescue operations at the facility? Is the plan adequate for all types of rescue operations that may be needed at the facility? Teams may practice in representative spaces, or in spaces that are “worst-case” or most restrictive with respect to internal configuration, elevation, and portal size. The following characteristics of a practice space should be considered when deciding whether a space is truly representative of an actual permit space:
 - 1. Internal configuration.
 - a. Open – there are no obstacles, barriers, or obstructions within the space. One example is a water tank.

- b.** Obstructed – the permit space contains some type of obstruction that a rescuer would need to maneuver around. An example would be a baffle or mixing blade. Large equipment, such as a ladder or scaffold, brought into a space for work purposes would be considered an obstruction if the positioning or size of the equipment would make rescue more difficult.

2. Elevation.

- a.** Elevated – a permit space where the entrance portal or opening is above grade by 4 feet or more. This type of space usually requires knowledge of high angle rescue procedures because of the difficulty in packaging and transporting a patient to the ground from the portal.
- b.** Nonelevated – a permit space with the entrance portal located less than 4 feet above grade. This type of space will allow the rescue team to transport an injured employee normally.

3. Portal size.

- a.** Restricted – A portal of 24 inches or less in the least dimension. Portals of this size are too small to allow a rescuer to simply enter the space while using SCBA. The portal size is also too small to allow normal spinal immobilization of an injured employee.
- b.** Unrestricted – A portal of greater than 24 inches in the least dimension. These portals allow relatively free movement into and out of the permit space.

4. Space access.

- a.** Horizontal – The portal is located on the side of the permit space. Use of retrieval lines could be difficult.
- b.** Vertical – The portal is located on the top of the permit space, so that rescuers must climb down, or the bottom of the permit space, so that rescuers must climb up to enter the space. Vertical portals may require knowledge of rope techniques, or special patient packaging to safely retrieve a downed entrant.