Confined Space Safety

Understanding the Requirements of Permit Required Confined Spaces

29 CFR 1910.146 Permit Required Confined Spaces

Objectives

- Describe a permit required confined space.
- Understand the requirements of OSHA Regulation 1910.146.
- Understand the safe work practices for working in an around confined spaces.

Part I

Confined Spaces Introduction

Confined Spaces Can Kill

- An August 17th, 2004, and employee at a Tulsa waste water treatment plant was killed when he entered a confined space and was exposed to an atmosphere containing hydrogen sulfide.
- The employee and employer did not:
  - Conduct atmospheric monitoring.
  - Use a respirator.
  - Provide Confined Space Training.
  - Have a Confined Space Program.

<Link to Article>

What is a Confined Space?

- A Confined Space is one where:

1. It has a restricted opening making entry and exit difficult.
2. It is large enough for a whole person to enter.
3. It is not designed to be occupied.

Is a walk in freezer a confined space?

Yes **No**

Permit Required Confined Spaces

- A confined space requires an entry permit when it has **any one** of the following:

1. An atmospheric hazard. (Real or potential)
2. The potential for entrapment or engulfment.
3. It is in a hazardous configuration.
4. It contains any other serious safety or health hazard.

This space has an atmospheric hazard, and the potential for engulfment, which makes it a **permit required confined space**.

These hazards must be dealt with prior to entry!

Atmospheric Hazard

- The OSHA definition:

1. Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit. (LFL)
2. Airborne concentration of dust that meets or exceeds the LFL.
3. Oxygen concentration below 19.5% or above 23.5%
4. Atmospheric concentration of any substance above permissible exposure limit of OSHA Toxic and Hazardous Substance list.
5. Any other atmospheric condition immediately hazardous to life or health.

Substance	Permissible Exposure Limit (PPM)
Carbon Dioxide	5,000
Carbon Monoxide	50
Hydrogen Sulfide	20
Methane	1,000
Nitric Oxide	25
Oxygen diflouride	0.05
Phosgene (carbonyl chloride)	0.1
Sulfur Dioxide	5
Stoddard Solvent	200

Permissible Exposure Limits of some atmospheric contaminants

What atmospheric hazards are at your facility?

Atmospheric Hazard – Silent Killer

- Valero Refinery
  - November 5, 2005 – Two workers at Valero Refinery died after entering a permit required confined space filled with nitrogen.
- Atmospheric hazards are the most common causes of death in confined spaces.
- You can't see it, touch it, or feel it, but it can be deadly.

Deaths caused by hazardous atmospheres are the most common causes of fatalities in confined spaces.

Engulfment

- The OSHA definition:
  - "The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing."
- Common examples of engulfment hazards:
  - Grain Silos
  - Storage Tanks
  - Sewer and water main work

What other examples can you think of that pose an engulfment hazard?

Hazardous Configuration

- The OSHA definition:
  - "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"

A wind turbine hub, which provides access to the long blades, is an example of a hazardous configuration.

What other examples can you think of for hazardous configurations?

Other "Serious" Hazard

- Permits are required when the employer determines that other serious hazards exist. These could be:
  - Extreme temperatures
  - Mechanical and hydraulic energy
  - Lighting problems
  - Noise
  - Slippery surfaces

If the confined space contains any safety hazards, it requires a permit prior to entry.

What other examples can you think of for safety hazards?

Part II

Confined Space Program Requirements

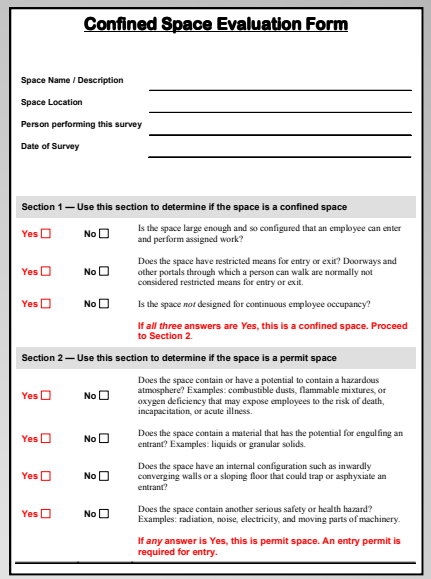
Posting of Permit Required Confined Spaces

- The employer must evaluate the workplace to determine if there are any permit required confined spaces.
- If the work place has permit required confined spaces, the employer must inform employees by posting danger signs.
- "Danger –Permit Required Confined Space, DO NOT ENTER!"

Signs must be sturdy, and located to warn employees of the hazardous space.

Reclassifying Permit Required Confined Spaces

- If all hazards from a confined space can be eliminated, the space can be reclassified as a non-permit required space.
- This means that the space has no real or potential atmospheric hazards, and all other hazards have been eliminated without entering the space.
- If changes to the hazard or configuration of the space occur, it may be reclassified as a permit required confined space.



Confined Space Evaluation Form

Space Name / Description _____

Space Location _____

Person performing this survey _____

Date of Survey _____

Section 1 — Use this section to determine if the space is a confined space

Yes ☐	No ☐	Is the space large enough and so configured that an employee can enter and perform assigned work?
Yes ☐	No ☐	Does the space have restricted means for entry or exit? Doorways and other portals through which a person can walk are normally not considered restricted means for entry or exit.
Yes ☐	No ☐	Is the space *not* designed for continuous employee occupancy?

If *all three* answers are Yes, this is a confined space. Proceed to Section 2.

Section 2 — Use this section to determine if the space is a permit space

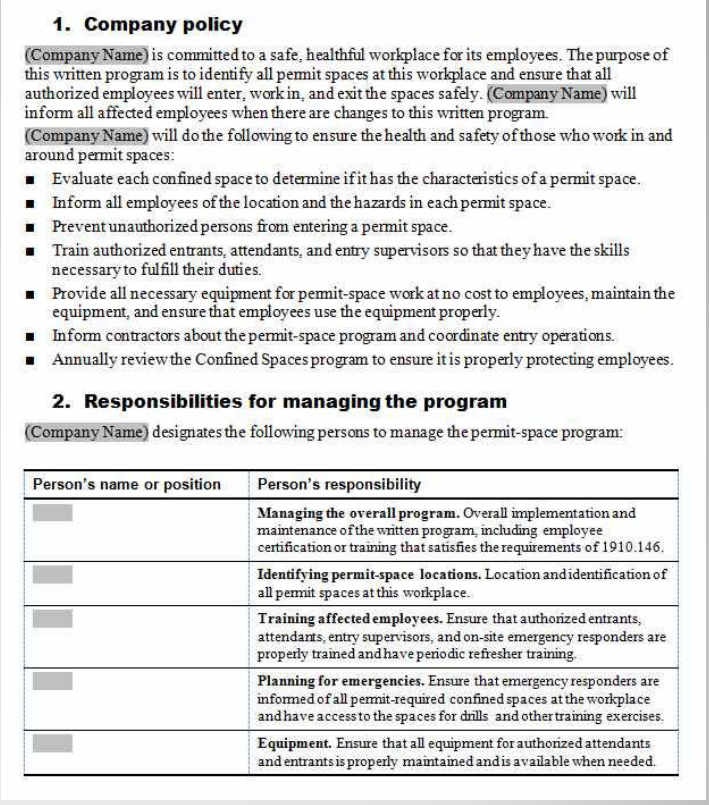
Yes ☐	No ☐	Does the space contain or have a potential to contain a hazardous atmosphere? Examples: combustible dusts, flammable mixtures, or oxygen deficiency that may expose employees to the risk of death, incapacitation, or acute illness.
Yes ☐	No ☐	Does the space contain a material that has the potential for engulfing an entrant? Examples: liquids or granular solids.
Yes ☐	No ☐	Does the space have an internal configuration such as inwardly converging walls or a sloping floor that could trap or asphyxiate an entrant?
Yes ☐	No ☐	Does the space contain another serious safety or health hazard? Examples: radiation, noise, electricity, and moving parts of machinery.

If *any* answer is Yes, this is permit space. An entry permit is required for entry.

Documentation detailing that the hazard was eliminated is required. The documentation must contain the date, location of the space, and the signature of the person certifying. This information must be made available to all parties.

Entry Permit Written Program

- All companies who have employees that enter permit required confined spaces must have a written entry program.
  - This program must be made available to all employees.
- If employees will not enter permit spaces, then the employer must take effective measures to prevent employees from entering.



1. Company policy

(Company Name) is committed to a safe, healthful workplace for its employees. The purpose of this written program is to identify all permit spaces at this workplace and ensure that all authorized employees will enter, work in, and exit the spaces safely. (Company Name) will inform all affected employees when there are changes to this written program.

(Company Name) will do the following to ensure the health and safety of those who work in and around permit spaces:

- Evaluate each confined space to determine if it has the characteristics of a permit space.
- Inform all employees of the location and the hazards in each permit space.
- Prevent unauthorized persons from entering a permit space.
- Train authorized entrants, attendants, and entry supervisors so that they have the skills necessary to fulfill their duties.
- Provide all necessary equipment for permit-space work at no cost to employees, maintain the equipment, and ensure that employees use the equipment properly.
- Inform contractors about the permit-space program and coordinate entry operations.
- Annually review the Confined Spaces program to ensure it is properly protecting employees.

2. Responsibilities for managing the program

(Company Name) designates the following persons to manage the permit-space program:

Person's name or position	Person's responsibility
	Managing the overall program. Overall implementation and maintenance of the written program, including employee certification or training that satisfies the requirements of 1910.146.
	Identifying permit-space locations. Location and identification of all permit spaces at this workplace.
	Training affected employees. Ensure that authorized entrants, attendants, entry supervisors, and on-site emergency responders are properly trained and have periodic refresher training.
	Planning for emergencies. Ensure that emergency responders are informed of all permit-required confined spaces at the workplace and have access to the spaces for drills and other training exercises.
	Equipment. Ensure that all equipment for authorized attendants and entrants is properly maintained and is available when needed.

Alternative Procedures

- Alternative Procedures rule (c)(5) allows employees to enter a confined space with an atmospheric hazard without a permit system provided that:
  - Verification is made that using continuous forced air ventilation is safe.
  - Inspection data supports that the atmosphere is the only hazard and forced air ventilation is effective.
  - Information is documented and provided to entrants.

Required Conditions:

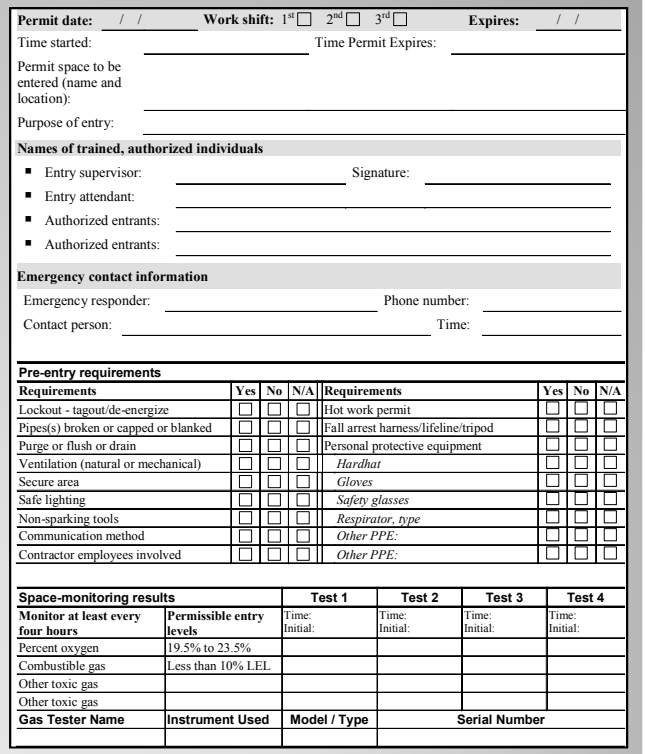
1. Safety is ensured before removing cover.
2. Atmosphere tests available.
3. Periodic atmospheric testing.
4. Evacuate immediately if necessary.
5. Verify procedures were followed with written certification.

Entry Permits

- All entry permits must contain:

1. Entry Purpose
2. Space to be entered
3. Date & duration
4. Authorized entrants
5. Attendants
6. Space Hazards
7. Isolation measures
8. Entry supervisor signature
9. Acceptable Entry Conditions
10. Test results with name of tester and the time
11. Rescue services available and how to contact
12. Communication Procedures
13. Necessary equipment for entry
14. Additional required permits
15. Other necessary information for a safe entry

Cancelled (Completed) permits must be retained at least one year .



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

Time started: Time Permit Expires:

Permit space to be entered (name and location):

Purpose of entry:

Names of trained, authorized individuals

- Entry supervisor: Signature:
- Entry attendant:
- Authorized entrants:
- Authorized entrants:

Emergency contact information

Emergency responder: Phone number:

Contact person: Time:

Pre-entry requirements

Requirements	Yes	No	N/A	Requirements	Yes	No	N/A
Lockout - tagout/de-energize	☐	☐	☐	Hot work permit	☐	☐	☐
Pipes(s) broken or capped or blanked	☐	☐	☐	Fall arrest harness/lifeline/tripod	☐	☐	☐
Purge or flush or drain	☐	☐	☐	Personal protective equipment	☐	☐	☐
Ventilation (natural or mechanical)	☐	☐	☐	*Hardhat*	☐	☐	☐
Secure area	☐	☐	☐	*Gloves*	☐	☐	☐
Safe lighting	☐	☐	☐	*Safety glasses*	☐	☐	☐
Non-sparking tools	☐	☐	☐	*Respirator, type*	☐	☐	☐
Communication method	☐	☐	☐	*Other PPE:*	☐	☐	☐
Contractor employees involved	☐	☐	☐	*Other PPE:*	☐	☐	☐

Space-monitoring results		Test 1	Test 2	Test 3	Test 4
Monitor at least every four hours	**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					
Gas Tester Name	**Instrument Used**	**Model / Type**	**Serial Number**		

A Sample Confined Space Entry Permit

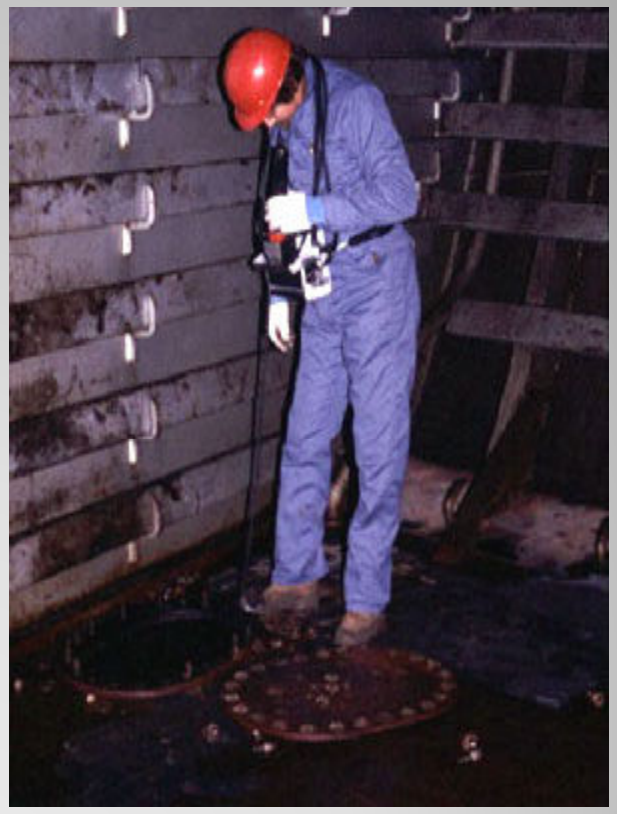
PRCS Entry Team – Supervisor

- Verifies permit by determining entry requirements are met.
- Familiar with the hazards of the space, including information on the mode, signs or symptoms, and consequences of exposure.
- Verifies that all tests required by the permit have been conducted, and that all equipment required by the permit is available.
- Supervisors entry.
- Verifies rescue services are available and can be contacted.
- Keeps space clear of unauthorized personnel.
- Makes sure that that the entry operation remains consistent with the conditions of the permit and that acceptable entry conditions are maintained.
- Ends entry evolution by cancelling the permit.

What other roles can a entry supervisor play?

PRCS Entry Team – Attendant

- Is aware of effects of possible hazards on attendants behavior.
- Familiar with the hazards and procedures of the space.
- Monitors and maintains count of entrants.
- Monitors activities and hazards in and around the confined space.
- Communicates with entrants.



What is missing from this confined space access point?

PRCS Entry Team – Attendant

- Stays outside entry point.
- Controls the entry point.
- Calls for rescue if required.
- Can perform non entry rescue if required.
- Performs no work that may distract from their attendant duties.

What other things should the attendant be alert for?

Guarding The Space

- The attendant must guard the space by:
  - Warning unauthorized persons to stay away.
  - Order unauthorized persons to exit the space if they have entered.
  - Alerting entrants if an unauthorized person has entered the space.

The attendant must enforce the exclusion zone.

Attendant Evacuation Order

- The attendant will order an evacuation of the space if:
  - A prohibited condition is detected.
  - Entrants exhibit behavior that is symptomatic of hazard exposure.
  - There is a condition outside the space that could affect the safety of the entrants.
  - The attendant can no longer perform their duties.

What could cause an attendant to order an evacuation?

PRCS Entry Team – Entrant

- Knows the hazards of the work.
- Can use equipment properly.
- Communicates with attendant.
- Alerts attendant if hazards change or new hazards develop.
- Exits the space if new hazards arise.

Confined Space Rescue Requirements

- There are two options available for a rescue program:

1. Arrange for rescue from an outside source.

2. Train your employees to provide rescue.

   - Employees must be trained in First Aid/CPR, can properly use required equipment and practice confined space rescue at least annually.

   - Equipment for non-entry rescue must be provided.

Non-entry rescue is the preferable means of rescue.

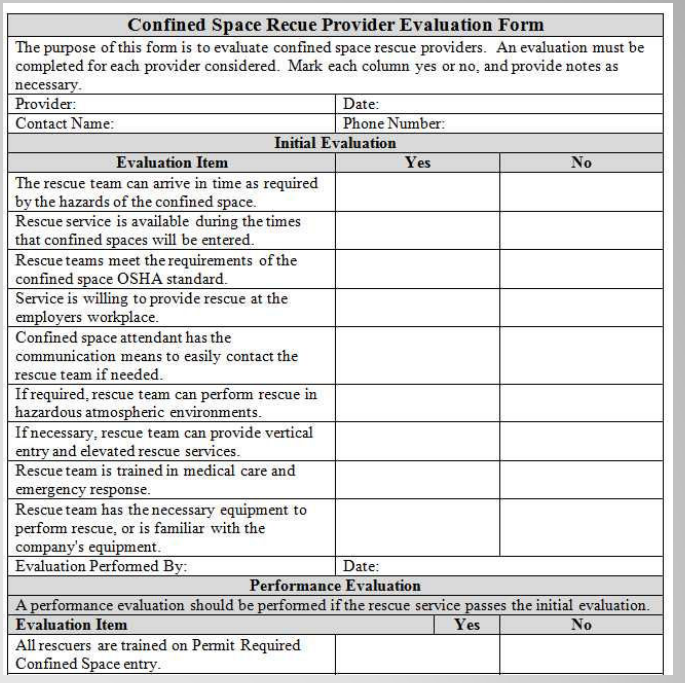
Outside Rescue Services

- The employer must evaluate a prospective rescuers ability to respond in a timely manner which is consistent with the hazards identified.
- The team must be proficient with the rescue related tasks and equipment required.

Can emergency services arrive in time?

Outside Rescue Services

- The employer must select a rescue service that:
  - Has the capability to reach the victim in a time frame appropriate for the hazards identified.
  - Is equipped and proficient at providing the type of rescue provided.
  - Is informed about the type of hazards they may encounter.
  - Have access to all permit spaces where rescue may be necessary so they can create plans and practice rescue.



Confined Space Recue Provider Evaluation Form		
The purpose of this form is to evaluate confined space rescue providers. An evaluation must be completed for each provider considered. Mark each column yes or no, and provide notes as necessary.		
Provider:	Date:	
Contact Name:	Phone Number:	
Initial Evaluation		
Evaluation Item	**Yes**	**No**
The rescue team can arrive in time as required by the hazards of the confined space.		
Rescue service is available during the times that confined spaces will be entered.		
Rescue teams meet the requirements of the confined space OSHA standard.		
Service is willing to provide rescue at the employers workplace.		
Confined space attendant has the communication means to easily contact the rescue team if needed.		
If required, rescue team can perform rescue in hazardous atmospheric environments.		
If necessary, rescue team can provide vertical entry and elevated rescue services.		
Rescue team is trained in medical care and emergency response.		
Rescue team has the necessary equipment to perform rescue, or is familiar with the company's equipment.		
Evaluation Performed By:	Date:	
Performance Evaluation		
A performance evaluation should be performed if the rescue service passes the initial evaluation.		
Evaluation Item	**Yes**	**No**
All rescuers are trained on Permit Required Confined Space entry.		

For spaces that could quickly fill with a dangerous atmosphere, rescuers would need to be at the space. If risks are only things like broken bones, 10 or 15 minutes away may be adequate.

Employee Provided Rescue

- Employees must be provided with and trained on PPE required to conduct rescues.
- Must be trained to perform rescue, including training on confined space entry.
- Must have current certifications on CPR and First Aid.
- Must practice rescue at least once a year.
- Rescue practices must be similar to actual spaces where rescue may be required.

Non-Entry Rescue

- Unless retrieval equipment would add to the space hazard, or not facilitate rescue, a mechanical rescue device and body harness must be used.
- The harness must be attached with a retrieval line to a mechanical device or fixed point outside the space.
- Must be connected in such a way that a rescue can begin as soon as the rescuer deems it necessary.
- Vertical type permit spaces of less than 5 feet deep do not require rescue devices.

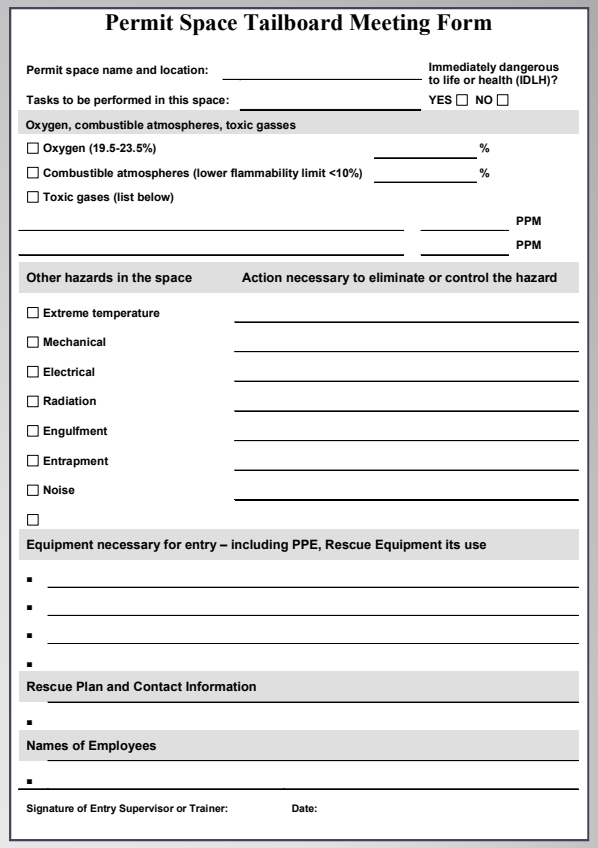
Non-entry rescue is the preffered method of rescue.

Part III

Confined Space Entry

Confined Space Tailboard Meeting

- Before starting a confined space entry operation, the crew should have a tailboard meeting.
- The supervisor, attendant, and entrants must attend.
- The meeting must cover:
  1. Review of the hazards of entry
  2. Review of required PPE
  3. Review of work procedure
  4. Review of rescue plan



Permit Space Tailboard Meeting Form

Permit space name and location: _____ Immediately dangerous to life or health (IDLH)?

Tasks to be performed in this space: _____ YES ☐ NO ☐

Oxygen, combustible atmospheres, toxic gasses

☐ Oxygen (19.5-23.5%) _____ %

☐ Combustible atmospheres (lower flammability limit <10%) _____ %

☐ Toxic gases (list below)

_____ _____ PPM

_____ _____ PPM

Other hazards in the space	Action necessary to eliminate or control the hazard
☐ Extreme temperature	
☐ Mechanical	
☐ Electrical	
☐ Radiation	
☐ Engulfment	
☐ Entrapment	
☐ Noise	
☐	

Equipment necessary for entry – including PPE, Rescue Equipment its use

- _____
- _____
- _____
- _____

Rescue Plan and Contact Information

- _____

Names of Employees

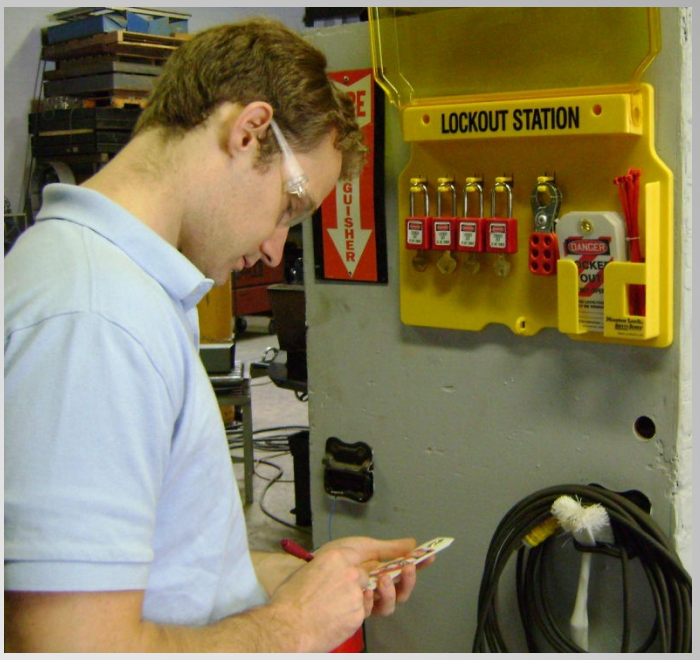
- _____

Signature of Entry Supervisor or Trainer: Date:

The tailboard meeting should be documented and kept with the permit.

Isolating The Space

- The space must be isolated from all hazards.
- This can be accomplished by:
  - Closing valves.
  - Installing blank flanges.
  - Draining the space.
  - Using lockout tag out equipment.



The space must be isolated and secured in accordance with the entry permit.

Accessing the Space

- Any conditions that make it unsafe to remove an entry cover must be eliminated before the cover is removed.
- When entrance covers are removed, the opening must be guarded to prevent accidental falls into the opening, and protect workers inside from objects entering the space.

Make sure the opening is guarded to prevent accidents!

Testing the Atmosphere

- Before an employee enters the space, the internal atmosphere must be tested for these items in the following order:

  1. Oxygen content.
  2. Flammable gas and vapors.
  3. Potential toxic air contaminants.

- Any employee who will be entering the space must be allowed to observe the pre-entry testing.

Oxygen is tested first because many meters will not detect other contaminants in low oxygen environments.

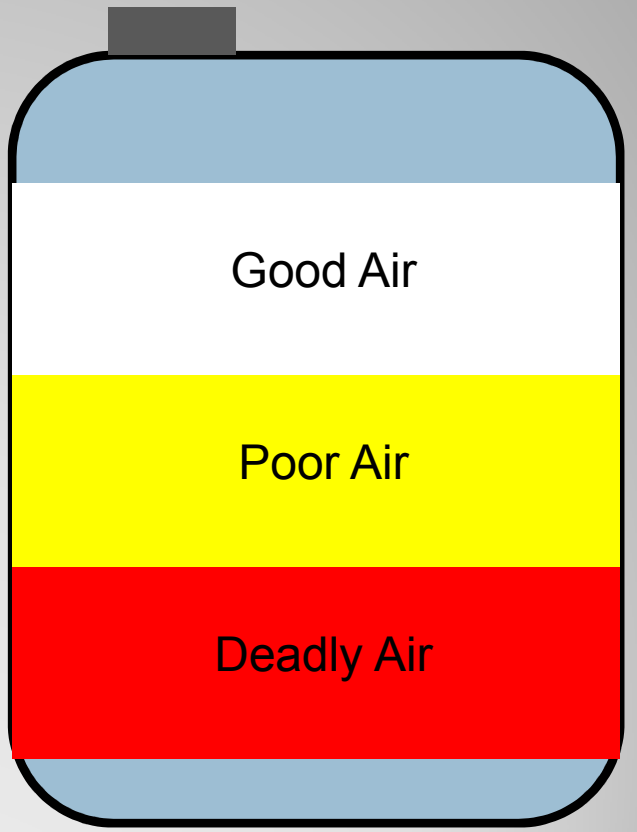
Testing the Atmosphere

- Atmospheres must be analyzed using equipment of sufficient sensitivity to identify and evaluate hazardous atmospheres.
- Evaluation of atmospheric data should be done by a technically qualified professional, such as:
  - A certified industrial hygienist.
  - A registered safety engineer.
  - A certified safety professional.
  - An OSHA consultation service.

Is anyone in your organization trained to perform atmospheric testing? Consulting with an industrial hygienist may be a good idea.

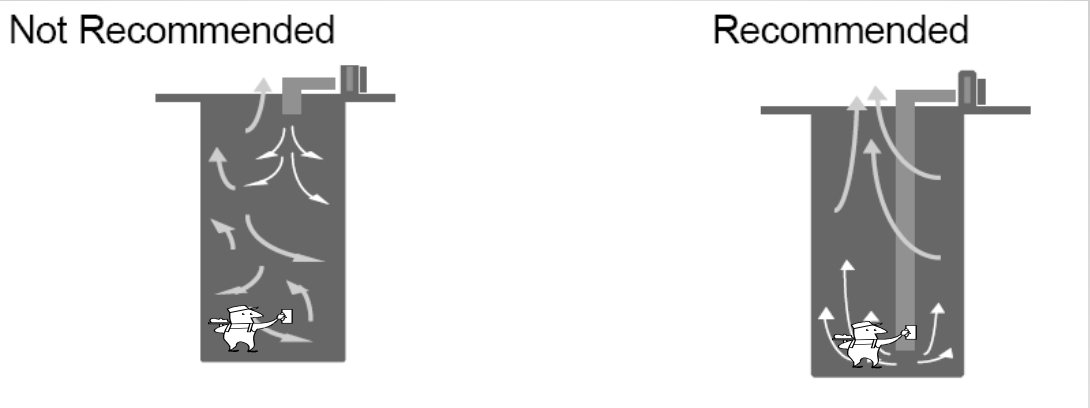
Testing The Atmosphere

- Be sure to test the atmosphere at different levels in the space.
- Good air near the opening of the space does not mean that there is good air at the bottom.



Confined Space Ventilation

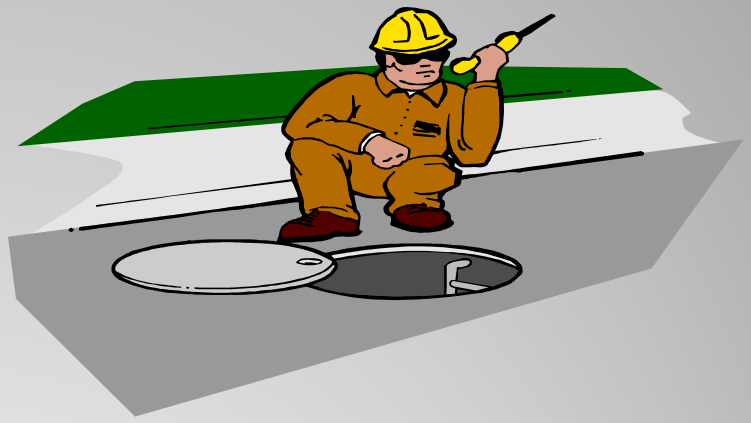
- Continuous forced air ventilation must be used to eliminate an atmospheric hazard. Employees are not allowed in spaces with hazardous atmospheres.
- It must:
  - Eliminate the hazard.
  - Be directed to the immediate work space of the entrant.
  - Be from a clean source and not increase the hazard in the space.
- The atmosphere in the space must be periodically tested to ensure effective ventilation.



Proper ventilation technique is important.

Communication

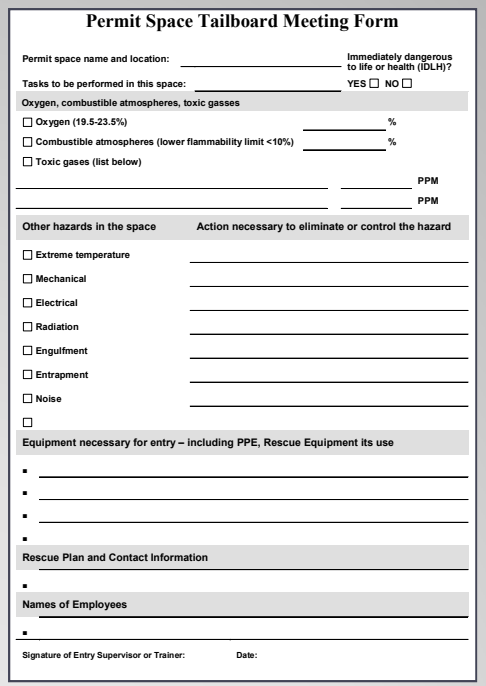
- Communication between the attendant and the entrants is important for confined space entry.
- Create a communication plan prior to entering the space.
- This may consist of verbal communication or radios.
- Test the communication system before starting work.
- Communication systems must have enough power to last the length of the work.



If using radios to communicate, make sure that they work in the space and that the batteries are fully charged.

Monitoring Work In The Space

- It is important to remain in frequent contact with employees in the space. Be alert for:
  - Changes in behavior.
  - An unexpected stop in work.
  - New or changing hazards.



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Oxygen, combustible atmospheres, toxic gasses

☐ Oxygen (19.5-23.5%) _____ %

☐ Combustible atmospheres (lower flammability limit <10%) _____ %

☐ Toxic gases (list below)

_____ _____ PPM

_____ _____ PPM

Other hazards in the space	Action necessary to eliminate or control the hazard
☐ Extreme temperature	
☐ Mechanical	
☐ Electrical	
☐ Radiation	
☐ Engulfment	
☐ Entrapment	
☐ Noise	
☐	

Equipment necessary for entry – including PPE, Rescue Equipment its use

- _____
- _____
- _____
- _____

Rescue Plan and Contact Information

- _____

Names of Employees

- _____

Signature of Entry Supervisor or Trainer: _____ Date: _____

Remember the hazards from the tailboard meeting and constantly monitor to ensure they are isolated.

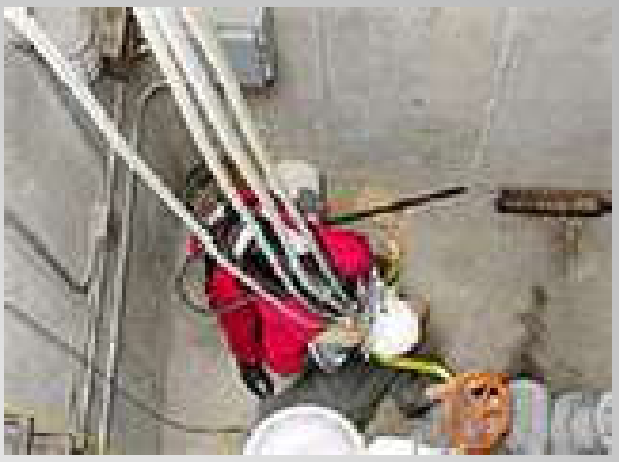
Performing Work In The Space

- Continuously monitor the space for a change in hazards.
- Do not perform work that was not briefed.
- If new work needs to be performed, exit the space, open a new permit, and re-brief the evolution.
- Always use the proper tools for the job.
- If you start to feel tired or ill, exit the space immediately.

Workers who initiate work that was not briefed risk introducing new hazards to the space.

Evacuating The Space

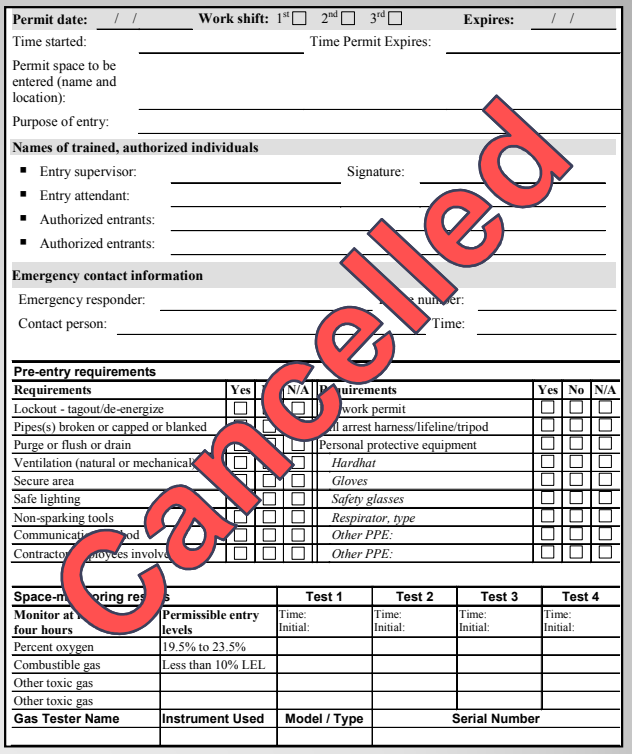
- If new hazards arise, evacuate the space immediately!
- Use the designated evacuation and rescue plan.
- Do not attempt an unplanned rescue, this is where most confined space fatalities occur.
- The space must be evaluated to determine how the hazard developed, and measures must be implemented to protect employees before re-entry is allowed.



Do not deviate from your emergency plan!

Completing the Work

- Once the work has been completed, the Entry Supervisor cancels the permit.
- Employees then return the space to its normal condition.
- The entry permit must be stored for at least one year.



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

Time started: Time Permit Expires:

Permit space to be entered (name and location):

Purpose of entry:

Names of trained, authorized individuals

- Entry supervisor: Signature:
- Entry attendant:
- Authorized entrants:
- Authorized entrants:

Emergency contact information

Emergency responder: s number:

Contact person: Time:

Pre-entry requirements

Requirements	Yes	No	N/A	Requirements	Yes	No	N/A
Lockout - tagout/de-energize	☐	☐	☐	work permit	☐	☐	☐
Pipes(s) broken or capped or blanked	☐	☐	☐	l arrest harness/lifeline/tripod	☐	☐	☐
Purge or flush or drain	☐	☐	☐	Personal protective equipment	☐	☐	☐
Ventilation (natural or mechanical	☐	☐	☐	*Hardhat*	☐	☐	☐
Secure area	☐	☐	☐	*Gloves*	☐	☐	☐
Safe lighting	☐	☐	☐	*Safety glasses*	☐	☐	☐
Non-sparking tools	☐	☐	☐	*Respirator, type*	☐	☐	☐
Communicati od	☐	☐	☐	*Other PPE:*	☐	☐	☐
Contracto ployees involve	☐	☐	☐	*Other PPE:*	☐	☐	☐

Cancelled

Space-m oring res s		Test 1	Test 2	Test 3	Test 4
Monitor at four hours	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					
Gas Tester Name	**Instrument Used**	**Model / Type**	**Serial Number**		

Contractors

- If an Employer has contractors performing permit space entry, they will:
  - Inform the contractor that the workplace contains permit spaces, and that entry is only permitted using a compliant entry program.
  - Inform the contractor of the hazards and history of the space.
  - Inform the contractor of any procedures, precautions or equipment required to safely access the space.
  - Coordinate entry operations with the contactor when both employer personnel and contractor personnel will be working in or near permit space.
  - Debrief the contractor at the conclusion of the entry operation regarding the program followed and the hazards confronted or created in the space.

Training Requirements

- Employees must be trained:
  - Prior to first assigned duty
  - Before there is a change in assigned duties
  - Whenever there is a change in permit space hazards
  - Whenever there is reason to believe the confined space procedures or implementation are inadequate.

Is this training sufficient to allow you to enter all confined spaces?
(Select One)

Yes **No**

Employees must be trained on the hazards and procedures for each individual space. This can be accomplished with the tailboard meeting.

Summary

- A Permit Required Confined Space has any of the following:
    1. Atmospheric Hazard
    2. Potential for engulfment or entrapment
    3. Hazardous Configuration
    4. Any serious safety hazards

- The PRCS Entry team consists of an Entry Supervisor, Attendant, and Entrant(s).

- Employers have two options for providing rescue:
    1. Train employees to provide rescue and provide non-entry rescue equipment.
    2. Contract with a third party rescue provider.

- Cancelled entry permits must be retained for at least one year.

Questions?