

The Real Dangers Threatening Workers Who Enter Permit Required Confined Spaces



Gary K. Yurt Sr.
President/Chief Safety Advisor
ISTS - Industrial Safety & Training Services
Louisville, Kentucky
gary@istsky.com | www.istsky.com

www.istsky.com

Introduction



Over 1.5 million workers enter confined spaces on an annual basis.

Serious injury or death in a confined space can be the result of asphyxiation, engulfment, electric shock, falls, and heat stress.

(OSHA) estimates that 85 % of these accidents can be prevented if proper safety precautions at work sites are initiated.

Definitions

Confined space means a space that:

- (1) Is large enough and so configured that an employee can bodily enter; and
- (2) has limited or restricted means for entry or exit; and
- (3) Is not designed for continuous employee occupancy.

Definitions

Permit-required confined space means a confined space that has one or more of the following characteristics:

- (1) Contains or has a potential to contain a hazardous atmosphere;
- (2) Contains a material that has the potential for engulfing an entrant;
- (3) Has an internal configuration such that an entrant could be trapped or asphyxiated or;
- (4) Contains any other recognized serious safety or health hazard.

Entry

Entry is when any part of a person's body passes through the opening of a permit-required confined space.



Common Features

Confined spaces are a common feature on sites and represent one of the highest risk areas unless entry and work is properly controlled.

1. Treatment units, tanks, service reservoirs;
2. Chemical handling and storage areas;
3. Pumping stations, wells, sumps, overflows;
4. Unventilated rooms, lofts, cellars and basements;
5. Sewers, manholes, pipelines and chambers;
6. Deep excavations;
7. Tankers;
8. Water towers and reservoirs.

Confined Space Statistics

- 65% of all fatalities were due to air quality problems
- More than 50% died in Water / Wastewater / Sewer / Construction industries
- 29% of all people who died were supervisors
- 60% of all who die are rescuers
- 25% died in spaces “ready to kill”

Data source BLS



Labeling

Access to confined spaces must be restricted by use of barricades or warning signs that state ***“Danger, Permit Required Confined Space, Do Not Enter”*** or equivalent wording.



The Entry Permit

Permit must be completed before entry is authorized by employer

Entry supervisor must sign the permit

Permit must be made available at the time of entry so entrants can confirm that pre-entry preparations have been completed



Post it!! so we can see it!!!



Hazard Assessments

Confined Space Hazard Assessment													
Space		Date Assessment Last Modified											
Confined Space - must meet all the below criteria Is a space in which an employee may be exposed to an unreasonable risk to health and safety from any of the following: - Is not designed for continuous employee occupancy - Contains or has the potential for engulfing an employee - Contains a substance that has the potential for engulfing an employee - Has a potential for hazardous atmosphere such that an employee could be injured or incapacitated by breathing existing gases or by a lack of oxygen - Contains any other recognized serious safety or health hazard													
Authorized Entry Points													
Top	Side	Bottom											
Hazards	Source/Type	Quantity & Quality (1)	Severity (2)(3)	Hazard Statement/Method									
Explosive Atmosphere		100% LEL											
Combustible Material													
Flammable Gases		100% LEL											
Flammable Liquids													
Flammable Solids													
Flammable Dusts													
Flammable Gases													
Flammable Liquids													
Flammable Solids													
Flammable Dusts													
Flammable Gases													
Flammable Liquids													
Flammable Solids													
Flammable Dusts													
Personal Protective Equipment Required													
Check	Type	Check	Type	Check									
	Gloves		Respiratory Protection										
	Eye Protection		Safety Harness										
	Head Protection		Other										
	Foot Protection		Other										
	Other		Other										
Ventilation Requirements													
Space Volume in cubic feet													
Natural or mechanical ventilation is required to be provided in the space. Additional ventilation may be required for certain activities, such as welding, grinding or other operations that would produce additional heat, dust or fumes. Entry Supervisor must ensure additional ventilation requirements based on tasks to be performed in the space prior to entry.													
Mechanical ventilation required for entry hazardous atmosphere contaminants													
<table border="1"> <thead> <tr> <th>Supply</th> <th>Exhaust</th> <th>Local</th> </tr> </thead> <tbody> <tr> <td>Volume (CFM) per ft³</td> <td>Volume (CFM) per ft³</td> <td>Volume (CFM) per ft³</td> </tr> <tr> <td>Point (1)</td> <td>Point</td> <td>Point</td> </tr> </tbody> </table>					Supply	Exhaust	Local	Volume (CFM) per ft ³	Volume (CFM) per ft ³	Volume (CFM) per ft ³	Point (1)	Point	Point
Supply	Exhaust	Local											
Volume (CFM) per ft ³	Volume (CFM) per ft ³	Volume (CFM) per ft ³											
Point (1)	Point	Point											
Ventilation & Purge Requirements													
20 Air Changes Per Hour		Adequate Blower		Initial Purge Time									

Training Requirements

All employees whose work is regulated by this section acquire:

- understanding
- knowledge
- skills

Must establish employee proficiency

Employer must certify training

Frequency

Before first assigned duties

Before change in assigned duties

Change in operations

Inadequacies in employee's knowledge



Authorized Entrants

Know the hazards

Properly use equipment

Communicate with attendant

Alert the attendant

Exit space



Attendants

Know the hazards
Be aware of behavioral effects
Can identify entrants
Remains outside
Communicates with entrants
Monitors activities inside and outside & orders evacuation
Summons rescue
Actions against unauthorized persons
Performs non-entry rescue
Performs no duties that might interfere with primary duty



Entry Supervisors

Knows the hazards
Verifies entry conditions
Terminates entry
Verifies rescue services
Removes unauthorized individuals
Ensures acceptable entry conditions are maintained



Rescuer Responsibilities

Understand the hazards of the space

Be 1st Aid and CPR trained

Understand appropriate entry procedures

Know how to use all rescue equipment

Train at least annually in rescue operation in confined space.



**Confined Space Training 29 CFR 1910.146
Authorized RESCUER**

**Proven Skills and Competencies Documentation
Form**

The following **students** participated in and showed competence in Confined Space entry per 1910.146

Lee Burnett, John Harrison, Ian Brown, Ray Danen, Bryan Robinett, Ivan Bullard, Jarrett Norcross, Tim Harrison, Brandon Atcheson, Robert Glass, Kendall Cuevas, Vince Crabtree, Greg Thoms, and Tim Davis

Date: 11/03/10

Procedure	Section	Satisfactory = S Unsatisfactory = U	Instructor Sign-off
Initial or Refresher Training	1910.146		<i>Ang K J</i>
Is Trainee 1 st Aid and CPR trained?	1910.146 7.1.3.7		<i>Ang K J</i>
Size up incident (What type of Space)	7.4.3	S	<i>Ang K J</i>
Identify information sources 1. Review current Permit 2. Review current Hazard Assessment 3. MSDS 4. Lockout reviewed	7.4.3	S	<i>Ang K J</i>
PPE Review (What type of PPE will be needed)	1910.132 1670 Annex H.1	S	<i>Ang K J</i>
Eye and Face Protection	1910.133 1670 Annex H.1	S	<i>Ang K J</i>
Use SCBA	1910.134 1404	S	<i>Ang K J</i>
SCBA Cylinder Change out	1910.134 1404	S	<i>Ang K J</i>
Selection of Head Protection Properly	1910.135 1670 Annex H.1	S	<i>Ang K J</i>
Is Foot Protection necessary, if so is chemical protection a must	1910.136 1670 Annex H.1	S	<i>Ang K J</i>
Wear Fall Protection Properly	1910.132 1670 Annex H.1	S	<i>Ang K J</i>

Hazards in Confined Spaces



Biggest Dangers to Workers are..

1. There are many dangers associated with confined spaces with one of the primary hazards being atmospheric.
2. Workers need to be able to identify and deal with hazards associated with confined spaces.
3. Examples of confined spaces in wastewater system include (but are not limited to), manholes, sewers, pipelines, storage tanks, wet wells, digesters and pump stations.
4. Atmospheric hazards may exist in other areas where wastewater or wastewater residues are processed. The use of personal gas detection equipment while working in a wastewater facility is recommended.

Potential Hazards in Confined Spaces

Oxygen Deficiency

- <19.5% or >23.5% oxygen concentration

Combustibles

- Methane
- Hydrogen
- Acetylene
- Propane
- Gasoline fumes

Toxic Materials

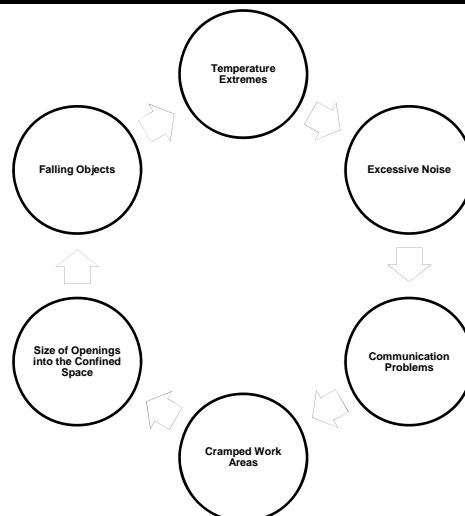
- Carbon Monoxide
- Hydrogen Sulfide
- Welding fumes
- Corrosives

Electricity

Mechanical Hazards

- Mixers
- Crushers

Other Hazards



Air Monitoring Spaces

- **Atmospheric testing is required for two distinct purposes:**
 1. **Evaluation of the hazards of the permit space**
 2. **Verification that acceptable entry conditions for entry into that space exist.**

Atmospheric Monitoring

There are nine basic rules for atmospheric testing.

Following these rules will help you achieve reliable results so that you can operate safely in confined spaces.

Atmospheric Monitoring

The **first rule** to remember when monitoring a confined space is to monitor in the proper order.

1. Monitor for corrosivity, to protect your monitor from atmospheres that are too corrosive.
2. Monitor for oxygen level, in order to be sure that you get an accurate flammability reading.
3. Monitor for flammability, assuming that the presence of toxic gases has not already caused you any distress, and the threat of combustion is immediate.

Finally, monitor for toxicity.

Atmospheric Monitoring

The **2nd rule** relates to vapor density

The **3rd rule** of atmospheric monitoring is to know your monitor's limitations.

The **4th rule** of atmospheric monitoring is to know your monitor's operational parameters.

The **5th rule** of atmospheric monitoring is to realize that many flammable gases are also toxic.

Atmospheric Monitoring

6th rule is to remember that some vapors migrate toward the exterior of the space, as if they were seeking openings to the outside. In other words, these vapors are coming to get you!

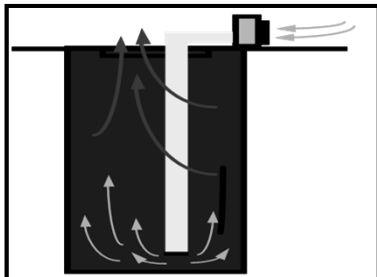
7th rule is to zero and inspect and field calibrate the monitor in an area with clean air.

8th rule is to sample from a small opening in the space before opening it up, and to position yourself upwind from the space while monitoring.

The **9th rule** for atmospheric monitoring is to make sure all batteries are charged sufficiently after each use.

Air Ventilation

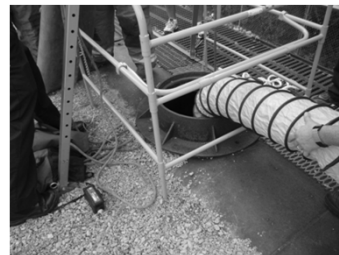
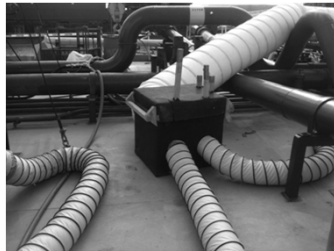
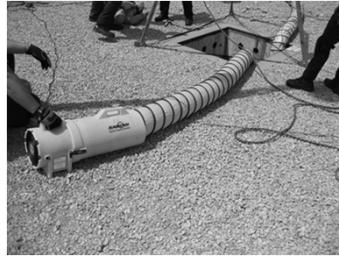
The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.



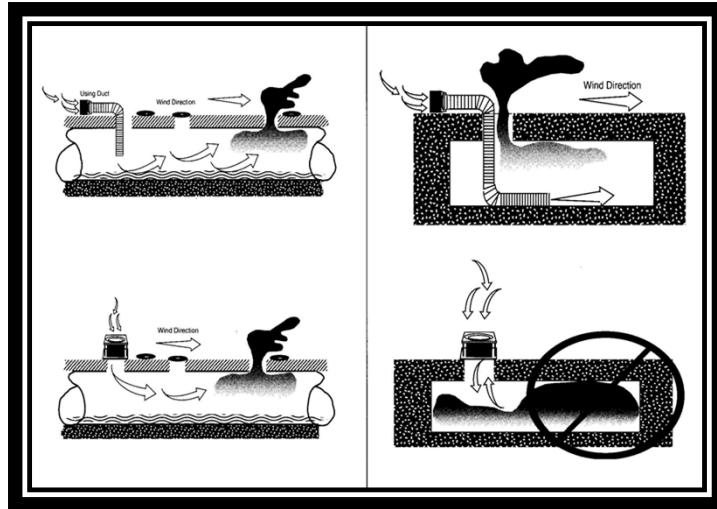
Natural ventilation alone will often not be sufficient to maintain breathable quality air. The interior configuration of the confined space does not allow easy movement of air within it.

Ventilation Equipment

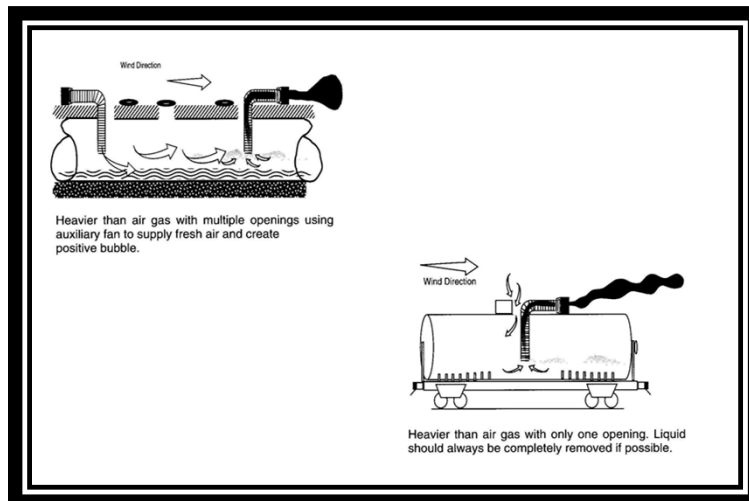
- Natural - rarely dependable
- Mechanical - preferred, positive hazard reduction depends on configuration consider nature of atmospheric hazard



Lighter Than Air Gases



Heavier Than Air Gases



Confined Spaces Examples

- Storage Tanks
- Covered pits and tunnels.
- Drainage pipes
- Boilers
- Open tank tops
- Tank cars, hopper cars and tank trailers.
- Excavations & Trenches
- Pipelines
- Sewers
- Manholes
- Valve pits
- Lift Stations
- Process Vessels
- Tunnels
- Underground Retention Basins
- Waste Water Tanks
- Catch Basins

Characteristics of Confined Spaces

(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.

Characteristics of Confined Spaces

(2) Elevation

- (a) Elevated -a permit space where the entrance portal or opening is above grade by 4 feet or more.
- (b) Non-elevated -a permit space with the entrance portal located less than 4 feet above grade.

Characteristics of Confined Spaces

(3) Portal size

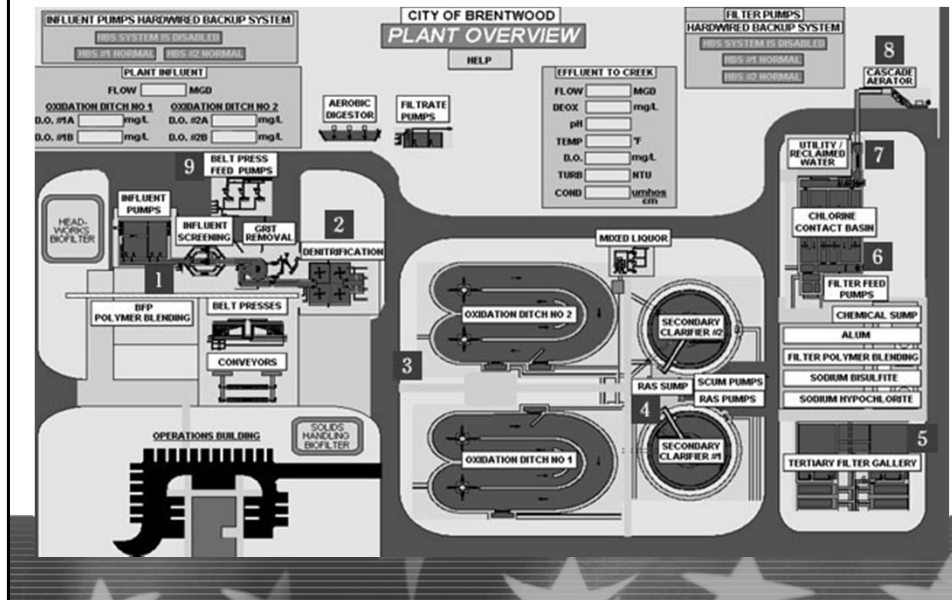
- (a) Restricted-A portal of 24 inches or less in the least dimension. Portals of this size are too small to allow a rescuer to simply enter the space while using SCBA.
- (b) Unrestricted-A portal of greater than 24 inches in the least dimension. These portals allow relatively free movement into and out of the permit space.

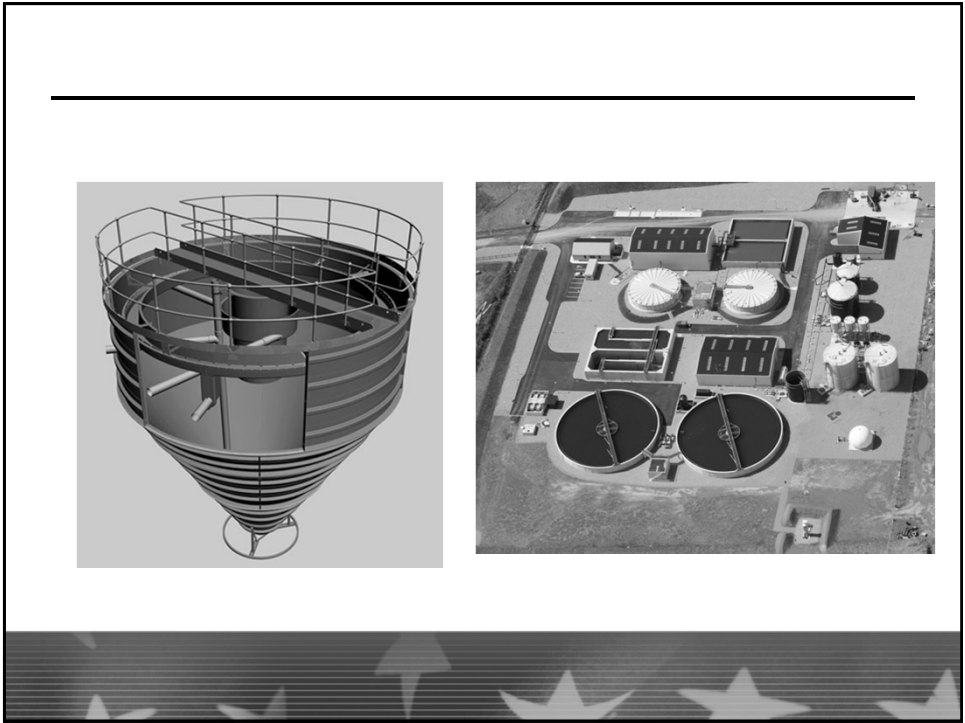
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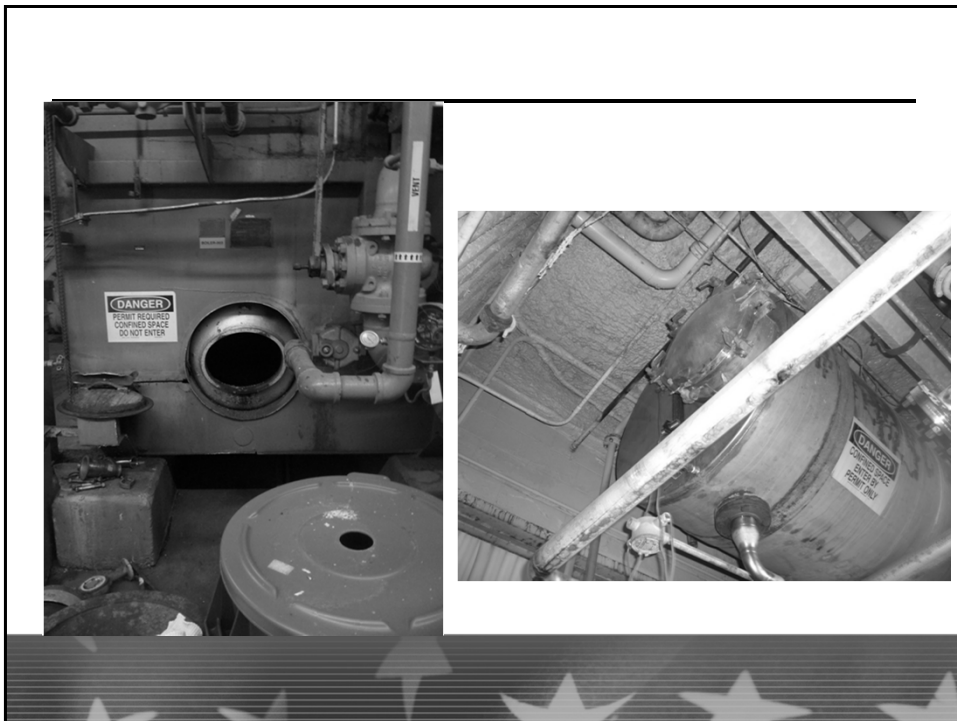
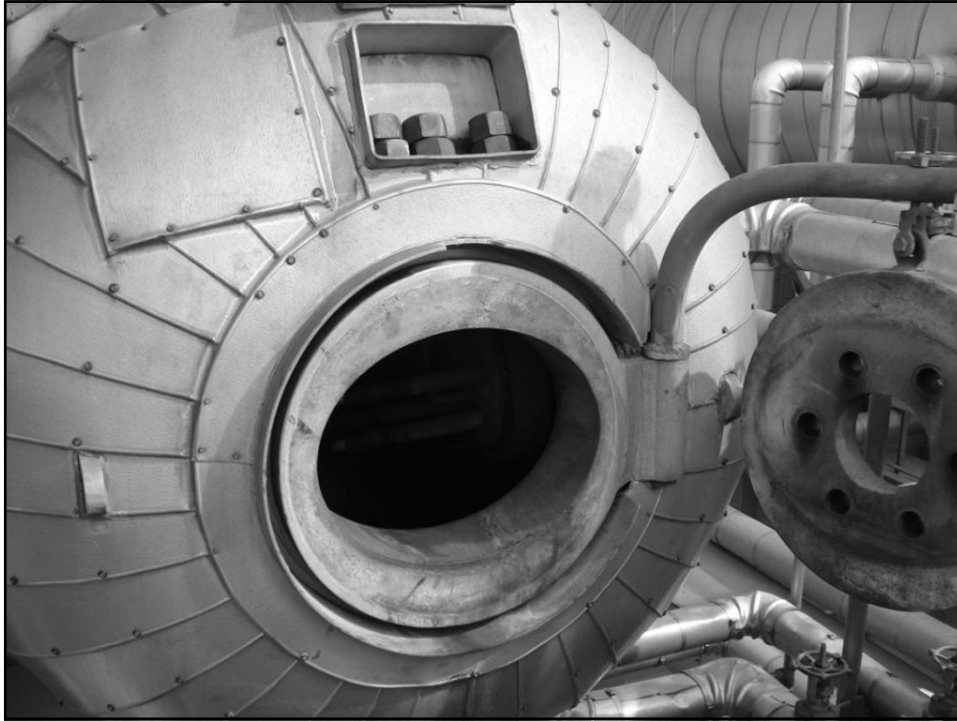
(4) Space access

- (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.

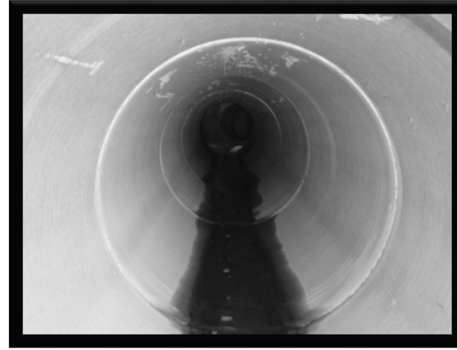
Can you find the Confined Spaces?







Confined Space Examples





Personnel Protective Equipment

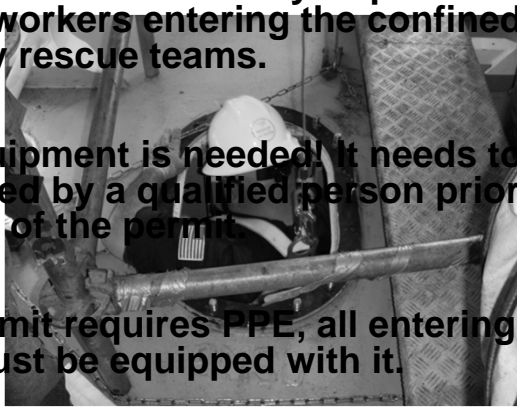


What Equipment is Needed

Certain permit entries may require the use of PPE by workers entering the confined space and/or by rescue teams.

What equipment is needed? It needs to be determined by a qualified person prior to the issuance of the permit.

If the permit requires PPE, all entering the space must be equipped with it.

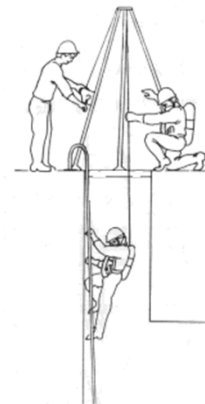


Head

Is there are any danger from falling objects, either from within the confined space or through the entryway?

Do obstructions or equipment in the confined space present a hazard?

If YES to either then you shall wear Head Protection



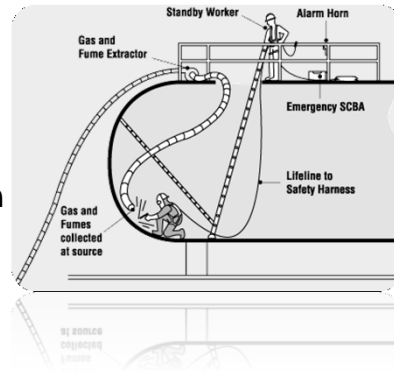
Entry with Hoist and Standby Personnel

Eye & Face

Will the workers encounter any irritant dusts, vapors, mists, abrasive particles or flying objects in the confined space?

If so, are safety glasses, impact goggles, chemical goggles or face shields the best choice for the conditions within the space and the work to be performed in it?

If the hazard will only be eye irritating, glasses or goggles may be sufficient.



Hand

Will the workers need protection from sharp edges and rough surfaces? Protection ranging from canvas to metal mesh gloves may be needed.

Gloves made of rubber or similar material may be worn to protect against toxic or irritating materials.

Will the workers encounter extreme hot or cold? Heat protective gloves or thermal insulating gloves may be necessary.

If there is a potential for electrical current flow through the body, rubber gloves may be called for.

Other considerations include whether workers will be handling slippery tools or materials.

Respiratory Protection

Follow your company's policy if respiratory protection will be required.

Does all entries require Respirators?

How do we determine the need?



Safety Harnesses

Each authorized entrant shall use a full body harness, with a retrieval line attached when entering a permit required confined space.

A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than 5 foot deep 1910.146(k)(3)

The other end of the retrieval line shall be attached to a mechanical device or a fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer/attendant is aware that rescue is necessary.

Hoisting Equipment



Hoist



Winch device

Emergency Retrieval Devices



Emergency Response



1. Arrange for rescue service from an outside source.
2. Arrange for your own employees to provide rescue.
3. Provide for non-entry rescue.

Plan for Emergencies

RESCUE procedures should be established before entry and should be specific for each type of confined space. A standby person should be assigned for each entry where warranted.



Recovery vs. Rescue

Recovery mode

Recovery mode is defined as situations where the victim is obviously expired or after a period of time during the rescue operation where time, conditions, or other factors have reduced the chance for the victim's survival to minimal.

Rescue mode

Rescue mode is defined as situations where the victim is believed or known to be alive. If this is unknown, personnel should operate in the rescue mode until time, conditions, or other elements make the chance for survival minimal.

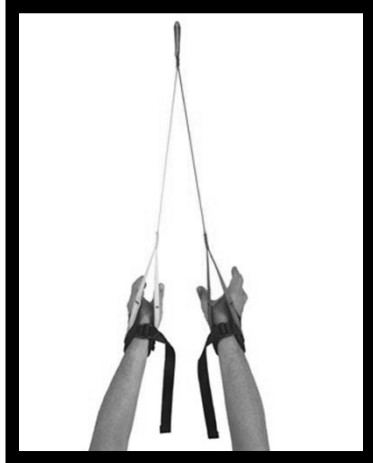


Special Tools for Rescues



An excellent way to perform a non-entry rescue on a victim wearing a harness. A telescoping aluminum pole with an attachment rescue clip.

Rescue Wristlets

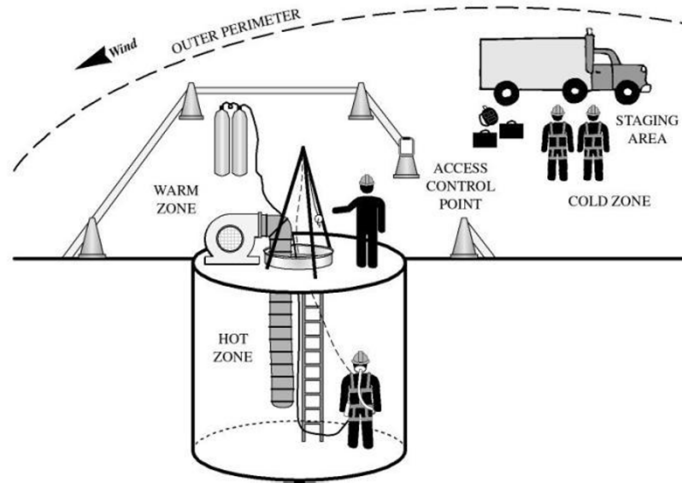


These wristlets are comfortable enough to wear all day. They fit perfectly and do not work loose. Special anatomically cut laminated foam encircles the wrist, and locking buckles keep them in place. Webbing lanyard allows flexibility of movement without excess weight.





ZONING THE WORK AREA



Summary

- Where entry into a confined space is unavoidable the persons entering, acting as top persons or supervising shall be trained and competent.
- Those persons going onto sites where confined spaces may be present shall be inducted to make them aware of the dangers.
- All confined spaces entries will be subject to a safe system of work, based on a risk assessment, which shall include the provision for emergencies, rescue and first aid appropriate to the risk.
- Be trained and familiar with the confined spaces ensure that employees who have to enter **confined spaces** or act as top person are trained and undergo an annual competency assessment.
- Ensure contractors are not allowed to enter **confined spaces** unless they can demonstrate competence.

