CONFINED SPACE - GOVERNMENT CONSTRUCTION

TITAN UNIVERSITY

Safety Course Series

CONSTRUCTION MANAGEMENT BEGINS WITH TITAN

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Confined Space Entry for Non-Marine Facilities

Confined Space safety applies to all confined space work performed in permanent, fixed facilities on construction sites and must be performed in accordance with:

- EM 385 1-1 Section 34
- 29 CFR 1910.146
- and ANSI Z117.1, Safety Requirements for Confined Spaces.

What is a confined space?

A confined space is an area that is not really designed for people, however the space is large enough for workers to enter the space and perform certain tasks.

A confined space has limited or restricted means for entry or exit and is not designed for continuous occupancy. In other words, a confined space doesn't have a door you open, you don't walk to your desk and you can't sit down at your desk and work in this space.

A confined space ***may*** have limited means of entry and exit, meaning you may have to squeeze through the space.

When you try and envision a confined space, imagine tanks, vessels, storage bins, vaults, and pits as examples. You may be working in a tunnel, a manhole, a pipeline, or even ductwork. These are confined spaces as well.

There are two classifications for all confined spaces

- Permit required confined space, and
- Non-permit required confined space.

A Permit Required Confined Space is a confined space with one or more of the following Four Factors:

1. Factor One: A Confined Space that either contains or has the potential to contain a hazardous atmosphere, such as gas.

2. Factor Two: A Confined Space that contains material which has the potential to engulf an entrant.

3. Factor Three: The space has inwardly converging walls or a floor sloping down to a smaller cross-section. Examples of this could be hoppers, silos, and dust accumulators.

4. And Factor Four: A confined space that has any other recognized hazards.

Here's an example of a Permit Required Confined space that resulted in a horrible accident which could have been avoided. This one falls under Factor One, hazardous atmosphere.

Four construction workers were working in a newly built and inactive sewer system on a jobsite that was unoccupied for over a week. Inactive meaning, the system was not hooked up yet.

A few minutes after they started working, the crew noticed that the foreman was missing, and a manhole cover was removed. While one worker called emergency services, a second worker entered the manhole to assist the foreman and found him unresponsive at the bottom of the 20-foot manhole.

When the second worker became disoriented inside the manhole, another worker used a fan to blow fresh air into the manhole and the second worker was able to climb out. But not the foreman.

The foreman was retrieved by fire department personnel and was later pronounced dead due to asphyxiation

So, what could have been the cause of this incident? There were probably several reasons.

Even though the manhole was new, and the sewer system was not hooked up, a hazardous atmosphere still existed. And the hazardous atmosphere resulted in the worker's death. So, here are the most likely causes of this incident.

- **Number One:** The employer did not ensure that atmospheric hazards were identified and precautions for safe operations implemented before starting work at the site.
- **Number Two:** The workers were not trained to recognize confined space hazards, so they didn't know the appropriate protective measures to take.
- **Number Three:** The atmosphere in the manhole was clearly not assessed to determine if conditions were acceptable before or during entry.
- **Number Four:** Proper ventilation was not used to control atmospheric hazards in the manhole.
- **Number Five:** Protective and emergency equipment was not provided at the worksite.
- **Number Six:** An attendant was not stationed outside the manhole to monitor the situation and call for emergency services right away.

Here's another example using ***Factor Two***, which is engulfment

During the week of June 6, 2011, three workers, one in Iowa, one in Michigan, and one in North Dakota, were killed when they were engulfed, meaning buried or trapped, by grain while on the job.

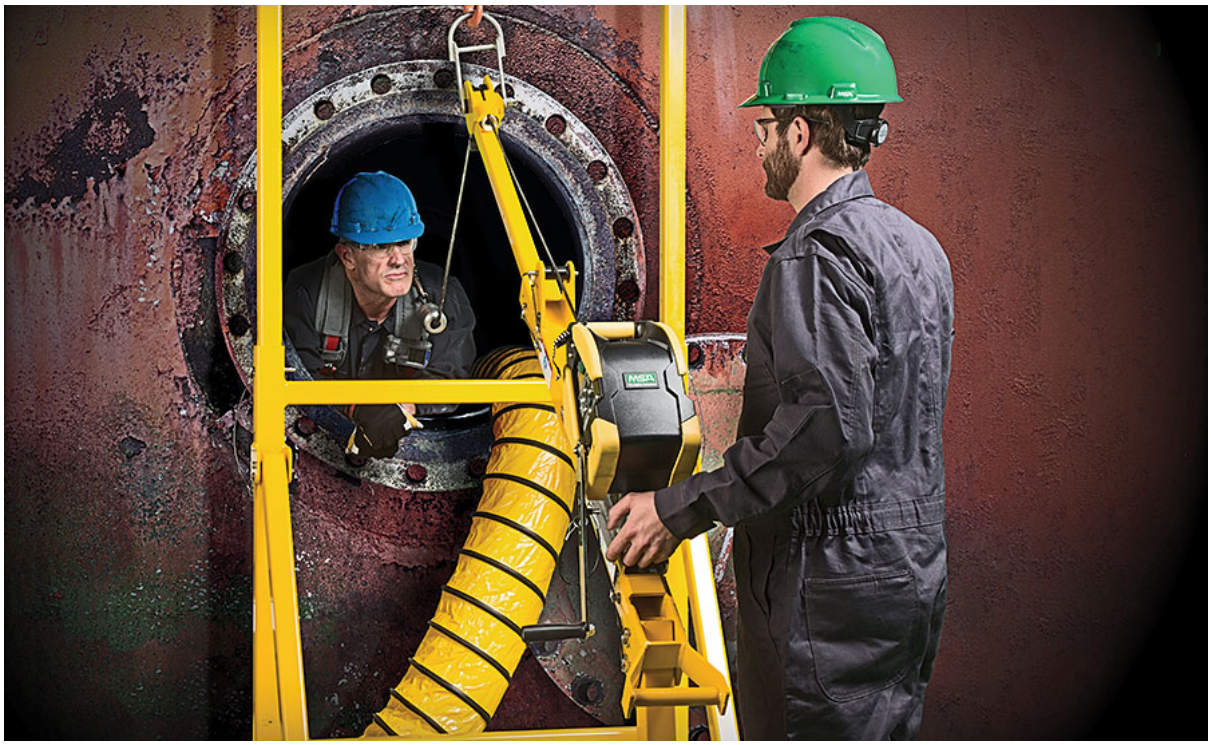
In Texas, a fourth worker was also buried in grain, but was rescued and survived.

Suffocation from engulfment is a leading cause of death in grain bins, and the number of these deaths continues to rise. These fatalities are preventable.

Grain can be a flowable solid, and if a person is pulled under the surface by the grain flowing downward, death could result from strangulation, asphyxiation, constriction, or crushing.

Let's park here for a minute. If you are engulfed or trapped in a situation like the one we're discussing, you'd more than likely never be able to clear out your lungs as you'll be trapped in a tight place and awkward position. And when you asphyxiate, it could take minutes, hours, and even days of suffering before the blood flow eventually shuts off. It's a terrible way to go and is crucial you understand confined spaces and safety precautions when you work around them.

A Permit Required Confined Space MUST be identified by the employer who MUST inform exposed employees of the existence and location of such spaces and their hazards.



The first step in implementing an effective confined space program is to conduct a facility-wide confined space assessment to identify all confined spaces.

Once all confined spaces have been identified, the second step is to identify those confined spaces that may pose a danger to employees. Again, these Four Factors are:

1. Factor One: The space contains or has the potential to contain a hazardous atmosphere. Such as gas.

2. Factor Two: The space contains a material that has the potential for engulfing an entrant. In our example we used a corn silo, but sand, dust, and water are also materials that may pose an engulfment hazard to employees.

3. Factor Three: The space as inwardly converging walls or a floor sloping down to a smaller cross-section. Examples of this could be hoppers, silos, and dust accumulators.

4. And Factor Four: The space contains other recognized serious safety or health hazards. This one is a little vague. For example, a piece of equipment with moving parts such as an auger. Or, dangerous material such as hot steam. An elevator shaft would meet this condition.

The examples given for permit required confined spaces are not exhaustive, however they are provided to give you an idea of what to look for when determining if the space will require a permit.

These spaces must be classified as permit-required confined spaces. Remember, to be a permit-required confined space, the space must only satisfy one or more of the Four Factors we previously discussed.

If you've worked on Government Projects for a while, speaking in acronyms is typical. So, it's best to understand some of the more common acronyms for confined space:

- CS means Confined Space.
- CPCS, means Competent Person Confined Space. And we'll talk about this in another chapter.
- CPCS SV, means Competent Person Confined Spaces in Ships and Vessels
- PRCS, means Permit Required Confined Space
- NPRCS means Non-Permit Required Confined Space

Let’s go over some definitions of common Confined Space language on Government Construction Projects. You’ll hear these terms quite often when you’re working on projects that require confined space.

Oxygen Deficient Atmosphere: Confined space with an oxygen content below 19.5% by volume.

Oxygen Enriched Atmosphere: Confined space atmosphere containing more than 23.5% oxygen by volume.

Attendant: An individual stationed outside the Permit Required Confined Space (PRCS), He or she monitors the entrance and performs attendance duties assigned in the employer’s permit required confined space program. If you remember the first confined space incident we talked about, where the foreman asphyxiated in a new sewer system, we discovered, there was not an attendant outside the PRCS.

Authorized Entrant: An employee authorized by the employer to enter a permit required confined space.

Entry Supervisor: The person responsible for determining if acceptable entry conditions are present, authorizes entry, over-sees entry operations, and terminates entry as required.

Emergency Responders: The CSCP shall coordinate with local emergency responders to determine if they're capable of a rescue from the confined space location, in 5 minutes or under. If the local

emergency responders do not have the appropriate rescue capability, this capability shall be developed onsite.

On construction sites and/or during Operations and Maintenance, all fixed permit-required confined spaces shall be labeled as a danger. Permit required confined spaces that are created as part of construction work shall be labeled and have a barrier to restrict entry.

When it comes to Confined Space identification, facilities and project sites must assign a safety supervisor or Confined Space Competent Person (CSCP) to identify all confined spaces and determine entry rules and requirements prior to performing the work.

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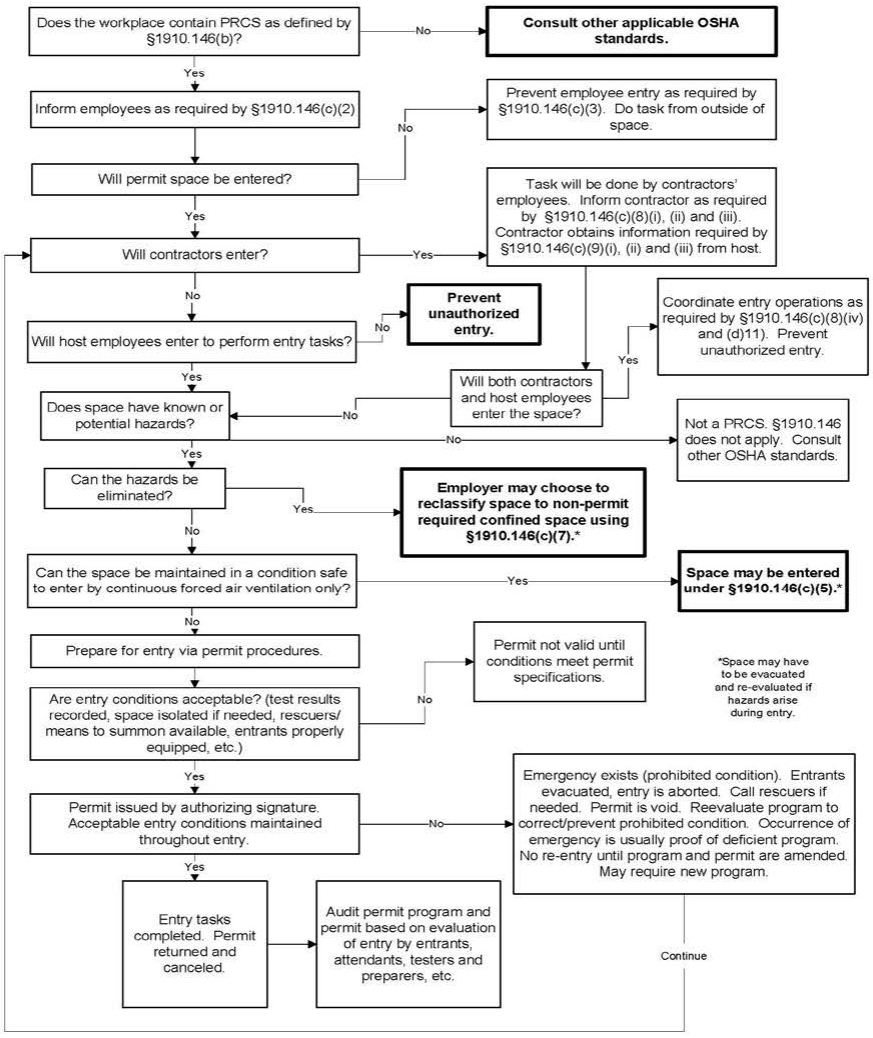
FIGURE 34-1

Confined Space Identification Flow Chart



At the end of the work tasks where a permit required confined space was entered, there shall be an after-action review by all parties. This review should cover all procedures used to document any improvement on the procedures which could have been used.

For USACE operations, this review must also include safety personnel for the site and any security or emergency responders for contract operations. Also included in the review will be the Government Designated Authority, or GDA, and all security or emergency responders onsite.

Some of the potential hazards in confined spaces would be

- An oxygen deficiency of less than 19 and a half percent or greater than 23 and a half percent.
- Combustibles such as methane, hydrogen, acetylene, propane, gasoline fumes, toxic materials such as carbon monoxide, hydrogen sulfide, welding fumes, corrosives, electricity, steam, and mechanical hazards such as mixers or crushers.

A Non-Permit Required Confined Space is a confined space that has been proven to have no potential for any hazardous atmosphere. They have no potential to contain any hazards capable of causing death or serious, physical harm.

An example of a non-permit required confined space would be a trench with the following conditions:

- The trench is greater than 4 feet deep, and
- There aren’t utility lines near the trench, and
- The atmosphere has been tested and the LEL readings and O2 level readings are acceptable
- Finally, no gas-powered equipment is in the trench.

The next term we talk about is another acronym. IDLH, which stands for Immediately Dangerous to Life and Health.

An IDLH respiratory hazard would be an atmosphere that poses an immediate threat to life, would cause irreversible and adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Per OSHA, 29 CFR 1910. 146, “Immediately dangerous to life or health” indicates any condition that:

- Poses an immediate or delayed threat to life
- Could cause irreversible adverse health effects, or
- Could interfere with an individual's ability to escape unaided from a permit space.

With a Permit Required Confined Space, the Confined Space Competent Person must complete, review, and sign the completed Permit Required Confined Space Permit.

A non-mandatory example of this permit is included at the end of this document. At a minimum, the entry log or form shall have the time and date, monitoring device type, model serial number, a calibration date, and the name of the individual doing the testing.

All Permits shall be signed by each employee entering the confined space. This includes the confined space competent person, attendants, and the responsible entry supervisor.

The Confined Space Competent Person is responsible and accountable for enforcing use of the permit required confined space permits and for entry into all permit required confined spaces at the facility or site.

The Confined Space Competent Person is a person with thorough knowledge of OSHA’s Confined Space Standard, 29 CFR 1910.146, has been designated in writing by the employer to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

In most Government Projects, the Confined Space Competent Person will sign the Activity Hazard Analysis (AHA) for the feature of work requiring confined space.

Another common term for confined space is Entry. Entry means the act by which a person intentionally passes through an opening into a permit required confined space. Any part of the body passing through the opening is considered entry.

Confined Space Team Members must meet certain responsibilities, such as to:

- Ensure the space has been adequately ventilated, isolated, emptied, or otherwise
- Check and make sure the space has been made safe for entry, or to immediately exit without question upon word of the attendant, no matter what the reason.
- Follow all safety rules and procedures that apply to the job.
- Be familiar with the work to be performed and procedures that apply to the job.
- Use the appropriate PPE whenever necessary.

In summary, entrants' responsibilities are to know the hazards, to properly use the equipment, to communicate with the attendant, and evacuate the permit required confined space permit if necessary, or when directed

The Attendant Responsibilities are as follows:

- Monitor entrance and exits during the job to ensure safety of the entrants.
- The attendant may not abandon his or her post for any reason while Personnel are in the space unless relieved by another qualified attendant
- Monitor atmospheric conditions in the space prior to and during entry.
- Control access to confined space
- Summon emergency assistance as needed
- Assess hazards in and around the space and act on the same.
- Keep records of confined space work such as air test results, personnel entry or exit.

The Confined Space Supervisor Responsibilities include:

- Ensuring protection is provided to the entrance by verifying adequate lockout tagout and that all hazards are securely isolated.
- Supporting the Attendance Authority in controlling access to a confined space
- Verifying that all personnel have exited prior to closing the space.
- Ensuring all Personnel involved are aware of the hazards associated with the space.
- And to confirm rescue services are available prior to entry.

Contractor Responsibilities are extremely important to know on Government Projects.

If an injured entrant is exposed to a substance that requires an SDS or other written information kept at the worksite, the SDS or written information must be made available to the medical facility treating the exposed Entrant.

In a Permit Required Confined Space Training Requirements by the Contractor Include ALL of the following personnel:

- Employees entering either permit-required, or non-permit required confined spaces
- Authorized Attendants
- Supervisors
- Managers
- Workers within visual contact of the confined space

Employees must be trained to understand the requirements of the facility or site, specific confined space entry program, procedures, and emergency retrieval procedures

For the Initial Confined Space Training, All entrants, authorized attendants, supervisors, and managers must receive an initial confined space training course that includes hands-on, practical exercises with all the equipment to be used in the confined space, rescue exercise, and completing the confined space permit.

Training also must include, at minimum, the roles, and responsibilities in conducting an entry, specialized training on the use, calibration, maintenance of monitoring communications and retrieval equipment, the hazards of the entry, and how to control the hazards of the entry.

Confined space training is required either when the hazards associated with the space change or annually, whichever is sooner. The training must include discussion of the hazards of the space, including:

- Symptoms of any hazardous materials encountered;
- Controls, including blanking and ventilation
- Warnings if the controls fail
- Personal protective equipment required
- And emergency procedures.
- Emergency procedure exercises on retrieving a person from the confined space.

This training for entrants must be documented on a certificate that includes the date of training, name of individual trained, the trainer, and the topics covered. The GDA will review the certificate.

Permit Required Confined Space Entry Steps (In Order)

1. Isolate the space
2. Ventilate the space.
3. Conduct a pre-entry meeting
4. Complete the permit.
5. Test the atmosphere
6. Enter the space

It's also important to note that all vertical permit required confined spaces must have a mechanical retrieval device when 5 feet or deeper in depth. The following methods, where applicable, must be used to isolate the space from all hazards

- Close all valves. They should either be double locked and bled or blank flanged.
- Empty the space. De-pressurize, vent, and drain
- Lockout and tagout the equipment. Such as, electrical sources, rotating and reciprocating parts, and hazardous materials
- Clean all residue from the space.
- Ventilate the space. Use mechanical ventilation such as fans or air horns. Ventilate at the rate of at least four volumes per hour. Larger spaces may require more ventilation.
- Make sure the Air Supply is not contaminated. The ventilation Air Supply must be from Fresh Air that's uncontaminated with flammables, toxins, or other items.
- Conduct a pre-entry briefing
- The entire crew must attend to include the Attendants, the Entrants, and the Entry Supervisor.
- Review hazards of entry and work
- Review the PPE requirements
- Review procedure for contacting rescue Personnel
- Verify that rescue is available
- Complete the permit

Let's talk a little about emergency rescue and response. if the project is using an on-site rescue team that has the same level of training as the Entrants. two members must be trained in First Aid and CPR and have a valid First Aid / CPR card, the team will use all PPE and equipment necessary for the rescue. And rescues must be practiced, at minimum, once every 12 months

If Off-site rescue teams are going to be used they must be informed of any and all hazards within the space. They also need to know when entrants are entering and exiting the space.

Entry Permit

As you could imagine, the Entry Permit, is important with all Permit Required Confined Spaces. The Entry Permit form must be correctly and completely filled out prior to entry because no one can enter the space without a valid permit. In addition: Once work is completed the permit and pre entry form are reviewed need to be reviewed by the team and canceled permits must be kept on file for at least one year.

The atmosphere of the space needs to be tested and done so in this order.

1. Check for oxygen content before and continual checking while the entrant is in the permit required confined space. The oxygen level shall be at least 19.5% and less than 23.5%

2. Check for combustibles. They should be less than 10% of lower explosive limit.

3. Check for toxic gases. The most common is carbon monoxide and its permissible exposure limit is less than 35 parts per million.

4. Check for any other hazardous materials that could be expected in the space.

This is very important. If a limit is exceeded, no matter the reason, all personnel shall immediately exit the space and no other shall enter until Atmospheric conditions are returned to safe levels.

During Permit Confined Space work, atmosphere testing procedures will include air tests that must be performed at various levels to ensure the entire space is safe. Good air near the opening does not mean there is good air at the bottom.

An Attendant will also be posted at the entrance for the duration of the work and he or she must be in constant communication with the Entrants while the job is in progress

- All entrants must sign the log when entering the space and sign out when exiting.
- The attendant will also maintain the permit and log for the duration of the work.

The Contractor Confined Space Program must be written to:

- Inform workers of the hazards within the space
- Include the Contractors established confined space entry procedure, including their own permit forms
- Identify their Contractor-supplied Attendants and Monitors
- Contractors must Supply their own monitors
- Ensure review after completion of the job.

The key to Confined Space safety is now in your hands.

TEXAS STATE UNIVERSITY SAN MARCOS
The rising STAR of Texas

CONFINED SPACE ENTRY PERMIT

PERMIT VALID FOR 1 SHIFT ONLY. ALL PERMIT COPIES MUST REMAIN AT THE SITE UNTIL SHIFT OR JOB IS COMPLETED.		
Date:	Site location #1:	
Site location #2:		Site location #3:
Site location #4:		Site location #5:

PURPOSE OF ENTRY: _____

Supervisor in charge of crew:	Type of Crew:	NexTel or Cell #:

Contractor:_____ Phone Number:_____

Communication procedures: ❑ Visual ❑ Life Line ❑ Voice Contact ❑Radio Signal

Rescue procedures: _____

BOLD INDICATES MINIMUM REQUIREMENTS TO COMPLETE AND REVIEW PRIOR TO ENTRY

REQUIREMENTS	YES	NO	N/A	REQUIREMENTS	YES	NO	N/A
Lockout/De-energize/Tagout				**Full Body Harness w/"D" Ring**			
Line(s) Broken-Capped-Blank				**Emergency Escape Retrieval Equipment**			
Purge-Flush and Vent				**Lifelines**			
Ventilation				Fire Extinguishers			
Secure Area (Post and Flag)				Lighting (Explosive proof)			
Breathing Apparatus				Protective Clothing (PPE)			
Resuscitator - Inhalator				Respirator(s) (Air Purifying)			
Standby Safety Personnel				Hot Work Permit (Burning and Welding)			

SAFETY STANDBY IS REQUIRED FOR ALL CONFINED SPACE WORK

SAFETY STANDBY ATTENDENT(S)	SIGNATURE

CONFINED SPACE ENTRANT(S)	SIGNATURE

PERMIT MUST BE AVAILABLE AT ENTRY LOCATION IN PLASTIC SLEEVE.