

CONFINED SPACE ENTRY

Confined Space Basics

According to the Cal-OSHA regulations, a confined space is an area, other than an underground working, that:

- is enclosed or partially enclosed,
- is not designed or intended for continuous human occupancy,
- has limited or restricted means for entry or exit that may complicate the provision of first aid, evacuation, rescue or other emergency response service, and
- is large enough and so configured that a worker could enter to perform assigned work;

An example of a confined space is the interior of a storage or treatment tank; these are spaces that most workers do not perform tasks in normally, however, may have to enter in order to maintain the space (e.g. performing inspections, maintenance, repairs etc.). Other kinds of confined spaces may include, but are not limited to: boilers, grain silos, pipelines, pits, sewers, storage bins, underground vaults, and vats.

Accidents in confined spaces are of special concern as they frequently result in multiple casualties. This is because they present risk to not only the workers who are initially at risk, but also to rescuers without sufficient training. In fact, more than half of those injured in confined space accidents are rescuers.

Therefore, whenever workers are required to enter confined spaces, they must have special training to ensure their competency in preventing such hazardous conditions as: the potential for oxygen enrichment and deficiency, flammable gas, vapor or mist, combustible dust, other hazardous atmospheres, harmful substances requiring lockout and isolation, engulfment and entrapment, and other hazardous conditions.

All workers must be highly trained and competent in confined space safe work requirements, protocols, procedures, equipment/tools, and protective equipment/devices and/or clothing. Other related training includes but is not limited to: performing lockout/tagout on electrical equipment, air quality testing methods, ventilation procedures, rescue methods/techniques and procedures etc.

Hazards of Confined Spaces

Because confined spaces have limited points of entry, they also have few opportunities for exit and poor ventilation. Confined spaces often hold hazardous air contaminants that can displace oxygen and can only be detected with a properly functioning/calibrated gas tester (or other acceptable means). Being exposed to a lack of oxygen can cause brain damage in fewer than four to six minutes and heart failure or loss of



consciousness almost instantly. Flammable gases increase the risk of potential explosions and fires if ignition sources are not eliminated and proper ventilation is not utilized. For all of these reasons, entering confined spaces without proper ventilation and testing is extremely risky. Conversely, experts agree that nearly all confined space deaths could have been prevented using proper ventilation and air testing techniques.

Specific hazards of confined spaces can include, but is not limited to:

- **Barrier failure/engulfment:** This type of failure may result in a flood of liquid or free-flowing solid like grain.
- **Biological hazards:** These might include those associated with animals (e.g. rodents), sewer-related processes, and exposure to biological agents such as bacteria, mould, pathogens, viruses etc.
- **Fire/explosions:** Any gaseous, liquid, or solid agent that renders the closed environment flammable or explosive can lead to increased risks to workers. Many substances can become more flammable or combustible in a confined space environment, depending on the chemical substance utilized.
- **Hazardous chemicals:** Exposures can result from ingesting, inhaling, and/or skin contact with various contaminants that may be present inside the space, or those that can be brought into or migrate into the space during work inside.
- **Occupational noise:** Operation of tools/equipment in a confined space, especially a metal one, can increase the levels of noise worker may be exposed to, notwithstanding the contribution to decreased communication between workers inside and those outside the space.
- **Poor air quality:** Many confined spaces do not have sufficient natural ventilation to ensure that workers will have good enough air to breathe reliably. Confined spaces might not contain enough breathable air to begin with, and are also likely to contain poisonous or toxic substances that can cause illness and even loss of consciousness.
- **Process-related hazards:** These hazards, related the chemical processing, can present risks from dealing with scales, sludges or residues that may seem harmless, until these are disturbed by some type of activity such as scraping, cleaning or heating.
- **Physical safety hazards:** These include entanglement in moving pieces of equipment (that are not properly locked out), falls, slips/trips, and/or structural hazards that may be present in the space.
- **Engulfment:** This hazard typically involves the inadvertent shifting or movement of bulk materials in confined spaces, which can bury workers and cause asphyxiation from not being able to breathe.
- **Temperature extremes:** Hazards from extreme hot or cold temperatures can lead to deleterious effects such as heat stress/stroke, white finger syndrome etc.



- **Uncontrolled energy hazards:** Not just limited to electricity, other forms of hazardous energy include thermal, electromagnetic, potential, mechanical, hydraulic, pneumatic etc.
- **Visibility:** Most confined spaces are not outfitted with permanent lighting systems, especially those where flammable/combustible substances or processes exist.

Why Work in Confined Spaces is More Hazardous Than Normal

Confined space accidents are frequently more dangerous than regular workplace accidents for the same reason that planning and training is so important: there is little margin for error in confined spaces. Any error in calculating the impact of a hazard can result in a very serious result such as a fatality. Examples why confined space work is inherently more hazardous than normal work are as follows:

- **Conditions can change quickly:** Because confined spaces are usually small in volume and typically have poor ventilation, conditions can quickly change which can lead to increased hazardous conditions in little time.
- **Dependent space:** The space or area outside a confined space almost always has a direct impact on the confined space itself. This means that conditions inside the space can change rapidly when conditions outside it change, such as operation of combustion equipment nearby the space. Workers inside may not be aware of these changes as they are “cut off” from the outside world.
- **Inadequate exits:** The exits of confined spaces often do not allow workers to escape quickly enough to avoid flooding, engulfment or toxic atmospheres.
- **Poor natural ventilation:** Lack of natural ventilation means that there is typically insufficient breathable air in confined spaces. It also means that suffocation, brain damage, and related issues are more likely in confined spaces.
- **Rescue may be difficult:** Both rescue from the outside by even trained/equipped rescuers or self-rescue can be very difficult in select spaces, due to their generally smaller sizes and their configurations,.
- **Work required in the space:** Once work commences in a confined space the work activities will change the space and introduce new hazards.



How to Properly Recognize, Assess, and Control Confined Space Hazards/Risks

There are several methods to eliminate or minimize confined space hazards/risks, in order to properly protect workers inside and prevent potential injuries or illness. These include, but are not limited to:

1. Confined Space Entry Program

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Each Employer is required to develop and implement a “Confined Space Entry (CSE) Program” that complies with the applicable health and safety regulations. The program provides for a management system that focuses on planning and prevention. All involved personnel are required to be instructed and trained the program and its requirements.

2. Confined Space Hazard Assessment

Prior to entering and working in a confined space, all Employers are required to have a “qualified person” who is very educated, trained, knowledgeable and experienced in the hazards of confined spaces. Each hazard must be clearly identified such that proper controls can be designed and implemented to mitigate those risks. All workers are required to be familiar with the hazards they may encounter in the spaces they enter and work in.



3. Work outside the confined space whenever possible:

The most ideal/best control to manage confined spaces is not to enter. As required by laws and industry best practices, Employers are required to conduct as much work from outside the space as possible, and/or render the space more safe by conducting such activities as emptying, draining, cleaning, purging etc.

4. Ensure proper confined space management/supervision:

Before commencing any work in a confined space, a “responsible supervisor” must be assigned by the Employer to ensure proper leadership and control on site. This supervisor must be highly trained and competent in managing confined space work, supervising involved personnel, and giving proper direction/instruction to their workers.

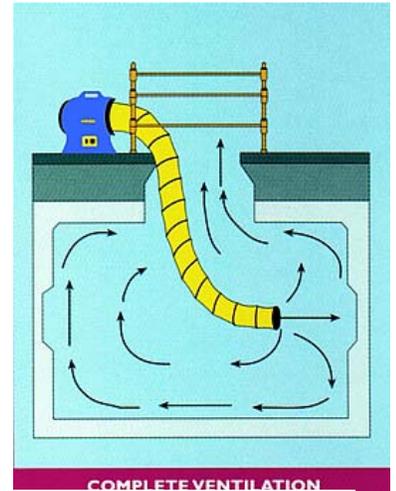
5. Air quality testing:

Before any entry into a confined space, the atmosphere must always be tested to determine what potential air contaminants may be present inside. Continuous testing must always be conducted by trained/competent workers (“standby person” or “hole/safety watch”) who are equipped and know how to use testing equipment that is regularly calibrated, maintained and is in good working order. The air test results must always be recorded on documents such as an entry permit, and the results reviewed with involved personnel to assure them that the air inside the space is “safe.”

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6. Air quality maintenance/ventilation:

Since natural ventilation is typically insufficient in confined spaces (if it is present at all), mechanical ventilation that provides clean, fresh, outdoor air into the space is crucial for worker protection. Very specific protocols/procedures are required regarding ventilation systems, which depends on such factors as: type(s) of air hazards, space design/configuration, location of work/workers, etc. The ventilation system(s) must be adequate to ventilate the every occupied confined space area. Workers are also not allowed to ventilate a space with oxygen as this can increase the possibility of a significant fire or explosion in the presence of uncontrolled ignition sources.



7. Hazard control methods:

Given the complexity of confined space hazards, the “Hierarchy of Control” (rank order of controls, from best to least best) is critical in ensuring ultimate work protection during work inside. These controls include eliminating the hazards, substituting a more hazardous material for a less hazardous one, engineering controls that reduce the exposure to hazardous chemicals, administrative controls (e.g. assessments, training, procedures, testing) and finally personal protective equipment (PPE) (as the “last line of defence”).

8. Fire/explosion prevention:

Where confined spaces may have contain flammable or combustible substances, the materials must be removed or greatly minimized to prevent fires and explosions. All “hot work” (e.g. welding, torching etc.) must not be conducted in the presence of flammable atmospheres. Explosion-proof equipment/tools may be required if a potential flammable atmosphere is identified in the hazard assessment.

Lastly...

The greatest tragedies resulting from confined space accidents are those they are mostly preventable, with proper planning, procedures and equipment/tools in place. **More rescuers die every year in confined spaces than the victims themselves.** However, with proper planning and foresight, as well as education/training, Employers can greatly reduce the possibility of confined space-related worker injuries, illnesses and even fatalities.

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