

Safe Tank Entry

When Entering Aboveground Storage Tanks (in service)*



What constitutes a confined space?

A “confined space” is a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; and (2) Has limited or restricted means for entry or exit; and (3) Is not designed for continuous employee occupancy.

A “Permit-required confined space” (PRCS) 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 by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or (4) Contains any other recognized serious safety or health hazard.

What constitutes an entry?

- Entry starts “as soon as any part of the entrant’s body breaks the plane of an opening into the PRCS.”

Where are tank entry regulations and guidance?

- In the USA, 29 CFR 1910.146 contains mandatory standards regarding PRCS.
- Industry standards API Std. 2015 and RP 2016 along with NFPA Std. 326 provide both general and specific explanations and guidance for preparing and working safely in tanks.
- ANSI Z117 addresses general confined space entry. OSHA provides a number of publications on confined space entry.

**For information about Confined Space Entry while tanks are being constructed, refer to 29CFR 1926 for the construction history.*

What are PRCS Roles/Duties?

Duties include but are not limited to:

- Entry Supervisor – the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a PRCS where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by 29 CFR 1910.146.
- Authorized Entrant - an employee who is authorized by the employer to enter a permit space.
- Attendant – an individual stationed outside one or more PRCS who monitors the authorized entrants and who performs all attendant’s duties assigned in the employer’s permit space program.
- Rescue Service - the personnel designated to rescue employees from a PRCS.

What are the Characteristics of Petroleum Storage Tanks?

Typically, aboveground petroleum storage tanks are “confined spaces” with limited entry through “manways” – relatively small openings in the side or top of the tank. The following potential hazards trigger PRCS characterization:

- Top entry can present falling hazards.
- The internal structure of tanks can be complex, which may not be apparent from the outside.
- Some tanks have internal floating roofs, which can move and trap workers.
- Tripping hazards may likely be present.
- The petroleum products typically stored in these tanks pose both a flammability and toxicity hazard that must be recognized.



Are Empty Tanks Hazardous?

- Historically, numerous incidents have involved “empty” tanks.
- Welding in and near tanks can ignite flammable vapors.
- Tanks that do not contain enough oxygen (less than 19.5%) can cause asphyxiation.
- Just because a tank has been “emptied” of its contents does not mean it is hazard free.
- A tank is never safe for entry until properly and thoroughly evaluated to ensure there are no actual or potential atmospheric hazards that can affect the oxygen content, flammability, or toxicity (see definition of “Hazardous Atmosphere”).

What Keeps Entrants Safe?

- Safe tank entry requires an evaluation of hazards (both physical and atmospheric) at the job site.
- The MSDS of the tank contents will help.
- Each permit-required confined space atmosphere must be tested using properly calibrated equipment.
- Entry Supervisors must be familiar with OSHA regulations, industry standards and the specific work to be performed in the tank.
- Understanding safe tank entry requirements and procedures leads to proper preparation and verified hazard control, such as tank isolation, ventilation and proper use of PPE.

What Are Safe Entry Priorities?

- Do as much work as possible without entry.
- Eliminate or isolate all potential hazards prior to entry.
- Use a written entry program, permits and trained personnel.
- Understand hazards before entry.
- Ventilate if needed, using forced mechanical ventilation.
- Test and inspect to evaluate and verify tank entry conditions.
- Communicate needs and requirements with employees, contractors and others working in vicinity.
- Coordinate all activities in accordance with 1910.146(c)8.

Tank Entry Good Practices

- Follow OSHA Permit Required Confined Space Standard, 29 CFR 1910.146.
- NEVER assume an “empty” tank is free of atmospheric hazards.
- Assume hazards are present until evaluated and verified.

- Evaluate all confined spaces to determine if they are Permit Required Confined Spaces.
- Prior to any hot work, ensure the tank is cleaned and gas-free. Check seals (especially foam) on floating roof tanks.
- Blind or blank piping connected to the tank or use “double block and bleed” to isolate systems. Assure the blind or blank is appropriately sized (includes thickness) to withstand pump pressure. If using a bleed line, assure it is sized to fully bleed the line it serves (see ANSI Z117.1).
- Lockout/tagout electrical connections.
- Lockout/tagout rectifiers for any cathodic protection systems connected to tank.
- Use approved low-voltage or ground fault circuit interrupter electrical equipment to reduce potential hazards.
- Disable tank heating and mixers, stirrers and similar mechanical equipment in accordance with lockout/tagout procedures (29 CFR 1910.147).
- Verify that Entry Permit conditions have been achieved.
- Calibrate gas detection meters often, at least before each day’s use.
- If tank oxygen content differs from outside air – find out why before entry and consider forced air ventilation to maintain oxygen content between 19.5-23.5%.
- Use approved lighting (electrically certified) to illuminate interior space.
- Make sure rescue services equipment is at site and that personnel are ready, available, and have been evaluated in accordance with 1910.146(k) and Appendix F.
- Make sure contractors have, understand and follow safe tank entry procedures and coordinate entries as required by 1910.146(c)8.
- Use proper PPE where required.
- Enter tank from ground level where possible.
- Keep track of who is in and out of the tank.
- Look for activities in adjacent areas that could affect confined space conditions.
- Notify nearby areas when doing tank entry.
- Use barriers to keep unauthorized personnel away.
- Restrict entry to tank when not working.
- Consider cutting a large door sheet opening in side of tank, if feasible.

The Dos and Don'ts of Safe Tank Entry

DO:

- Get all necessary permits
- Post copy of permits at job site
- Understand tank type and contents before entry
- Get copies and review all product MSDS
- Identify and test for hazards before entry
- Expect product under tank bottom or wherever product may become trapped (pontoons, columns, legs, interstitial spaces between double walls, double bottoms, etc.)
- Secure floating roofs to prevent vertical movement or rotation (see API 2016 for additional information on floating roofs)
- Use proper ventilation
- Ventilate with air flow away from workers and directed away from outside sources of ignition
- Maintain two-way communication between entrant and attendant
- Evacuate personnel and cancel permits if conditions change or new hazards found
- Ensure entrants are trained
- Have competent supervision
- Have PRCS attendant
- Choose “cold work” over “hot work”
- Use approved power tools
- Know welding generates fumes
- Keep all compressed gas cylinders outside tanks
- Avoid clutter – use good housekeeping
- Identify any ignition sources
- Have rescue services available to respond in a timely manner based on hazards

DON'T:

- DO NOT enter PRCS without proper permits
- DO NOT perform hot work without permit
- DO NOT work where “too rich to burn”
- DO NOT depend on 19.5% oxygen as “safe”
- DO NOT ignore health concerns
- DO NOT enter tanks without training

Key References for Work Inside Aboveground Storage Tanks

OSHA Standards:

- OSHA 29 CFR 1910.146: *Permit-Required Confined Spaces & 1910.1200 Hazard Communication*

Other Resources:

- OSHA Publication 3138: *Permit-Required Confined Spaces*
- API Std. 2015: *Safe Entry and Cleaning of Petroleum Storage Tanks*
- API RP 2016: *Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks*
- NFPA Std. 326: *Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair*
- STI/SPFA SP001: *Standard for Inspection of Aboveground Storage Tanks*
- ANSI/ASSE Z117: *Safety Requirements for Confined Spaces*

For more information on regulatory guidance, visit OSHA Standards and Publications at www.osha.gov or visit your state's Department of Labor. Non-regulatory confined space entry information can be found in the standards, publications or books from API (www.api.org), the National Fire Protection Association (www.nfpa.org), the Steel Tank Institute (www.steel tank.com) the American National Standards Institute (www.ansi.org), the American Society of Safety Engineers (www.asse.org), the American Industrial Hygiene Association (www.aiha.org) and the National Institute for Occupational Safety and Health (www.cdc.gov/niosh).

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