Confined Space Air Monitoring

Summary

Over the last five years more than 100 U.S. workers were fatally injured while working in confined spaces with hazardous atmospheres. These fatalities occurred in a variety of industries including manufacturing and construction. (U.S. Bureau of Labor Statistics data 2003 – 2007)

Proper testing of the atmosphere within a confined space is a critical, and potential life-saving, step in the confined space assessment and entry process. The Occupational Safety and Health Administration (OSHA) in its general industry Permit-Required Confined Space Entry Standard, 29 CFR 1910.146, mandates that all confined spaces with a potentially hazardous atmosphere be tested prior to entry.

29 CFR 1910.146(c)(5)(ii)(C) states “Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any employee who enters the space, or that employee's authorized representative, shall be provided an opportunity to observe the pre-entry testing required by this paragraph.”
What is a Confined Space?

A confined space is a space that meets all of the following criteria.

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry and exit); and
- Is not designed for continuous employee occupancy.

Examples of common confined spaces include process and storage tanks, pits, silos, and tunnels. There are two types of confined spaces; Permit-Required Confined Space and Non-Permit Required Confined Space.

What is a Permit Required Confined Space?

A permit-required confined space is a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- 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
- Contains any other recognized serious safety or health hazard.

What is a Non-Permit Confined Space?

A confined space that has been evaluated and determined not to contain or, with respect to atmospheric hazards, not to have the potential to contain any hazard capable of causing death or serious physical harm, is considered a "Non-permit confined space".

When is Atmospheric Testing Required?

Atmospheric testing is required every time an employee enters a permit required confined space containing, or having the potential to contain an atmospheric hazard.
Atmospheric testing may also be required when evaluating a confined space to determine if it is a permit required confined space. Specific procedures for confined space atmospheric testing are found in Appendix B of 29 CFR 1910.146.

What Atmospheric Testing is Required?

The OSHA Confined Space Standard, 29 CFR 1910.146(c)(5)(ii)(C) states: “Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order.” When evaluating and classifying a confined space a thorough evaluation should be made to determine what, if any, toxic air contaminants may be present or have the potential to be present in the space. Consider process piping in the space and chemicals that may be brought into the space such as cleaning agents or coatings. Also consider chemical use in adjacent operations or nearby the confined space as these contaminants may have the potential to enter the confined space. When entering a space where the atmosphere may be stratified, such as a sewer or pit, the atmosphere should be tested at four foot intervals in the direction of travel and to each side.

How Frequently Should the Atmospheric be Tested?

Testing should be conducted prior to each confined space entry and the atmosphere should be periodically tested as necessary to determine that acceptable entry conditions are maintained during entry operations. Continuous monitoring during entry is the recommended practice.

Gas Detection Basics

A variety of direct-reading, portable gas detection instrumentation equipment is available for confined space classification and atmospheric testing. No matter which type of instrument is used personnel using the equipment must read the operating manual and thoroughly understand its proper use and limitations. Portable gas detection equipment is typically available in units that can sample from just a single gas to those that contain sensors for up to five gases. A variety of sensors, including Photo Ionization Detectors (PIDs) are available making portable detection units extremely versatile for use in many applications. It is important to be sure that the proper sensors are selected for the atmosphere to be monitored.
All gas detection instruments should be calibrated and “bump tested” on a schedule recommended by the manufacturer, or more frequently if necessary. It is recommended that all calibration and maintenance be documented and the records retained. Instruments used for confined space monitoring and entry should be equipped with both an audible and visual alarm to warn the confined space entrant and attendant of the presence of a hazardous atmosphere. Other features such as an external or internal air pump are often available to aid in the confined space monitoring process.

Other OSHA Standards

The OSHA Construction standard (29 CFR 1926) and Shipyard standard (29 CFR 1915) have specific requirements for atmospheric testing during underground operations and confined space entry, respectively. These standards should be followed by employers as applicable.

Confined Space Monitoring in Construction

Under the OSHA Construction Standard a "confined or enclosed space" means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

Confined Space Monitoring in Shipbuilding

Under the OSHA Shipbuilding Standard a confined or enclosed space is defined as an area on a vessel or vessel section or within a shipyard such as, but not limited to: cargo tanks or holds; pump or engine rooms; storage lockers; tanks containing flammable or combustible liquids, gases, or solids; rooms within buildings; crawl spaces; tunnels; or accessways. Monitor confined or enclosed spaces with potentially hazardous atmospheres for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Confined or enclosed spaces with potentially hazardous atmospheres should be monitored prior to entry and continuously during entry.
Additional Information

Additional information on confined spaces and confined space atmospheric monitoring requirements can be found at www.OSHA.gov.