


 All BNP Media 

Wednesday, Jan 26

**content**

- [ISHN Archives](#)
- [Current News](#)
- [Current Features](#)
- [Newsletter Archive](#)
- [Products](#)
- [Vendor News](#)
- [Behavioral Safety](#)
- [OSHA Resources](#)
- [Ergonomics](#)
- [E-Learning](#)
- [20th Annual White Paper](#)
- [Calendar of Events](#)

**services**

- [Market Research](#)
- [Buyers Guide](#)
- [NEW! Showrooms](#)
- [Tech Q&A](#)
- [Write For Us](#)
- [Subscriptions](#)
- [Career Search](#)
- [Sites To See](#)
- [EHS Certifications](#)
- [Reprints](#)
- [List Rental](#)
- [ASSE Bookstore](#)

**advertising**

- [Classified Ads](#)
- [Media Kit](#)
- [Contact Us](#)
- [Home Page](#)



Want to use this article? [CLICK HERE](#) for options!

<< [BACK](#) | [ISHN HOME](#)

## Welding in tight spaces

Be aware of hazards in the air

By **Dave Kuiawa**

POSTED: 04/01/2004

The task of welding entails a myriad of physical hazards that can potentially threaten worker safety. Protective clothing is a necessity to shield workers from burns that may result from metal flash and the welding or cutting element itself. Eye protection is needed because of the danger brought about by the intense light caused by the welding process.

These hazards are obvious, and industry's workers would not even consider doing the work without utilizing the proper personal protective equipment (PPE). There is one hazard, however, that looms as perhaps the greatest danger — one that can have catastrophic results if not understood and dealt with in a safe manner — unseen hazards from gases.

### Confined environment

Welding or cutting in an open air environment poses little threat for the accumulation of gases. This is because the air around the process is moving and there is a large environment in which resultant gases can diffuse. When welding or cutting in confined spaces, however, the situation is distinctively different and one must evaluate and continuously monitor the environment to ensure safe completion of the task. The majority of confined space work occurs when a plant is in a turn-around, shutdown or outage situation. Some common tasks include vessel repairs, welding pipeline or tank seams, and the cutting and removal of unused tanks.

Prior to entering any confined space, one must determine if the environment is safe for human entry and safe to commence with the task at hand. To better understand what is needed let's first look at the definition of a confined space. OSHA in its *Federal Register*, 29 CFR 1910.146, defines a confined space as any space that has limited openings for exit or entry, poor natural ventilation, not designed for continuous worker occupancy, or has the potential for hazardous environments. This criterion broadens the scope of confined spaces from anything from an open top digester, to a traditional vault, sump or manhole.

Often referred to as "hot work," the entrant must first evaluate the space prior to entry. This is done with a direct reading, calibrated multi-gas monitor. The *Federal Register* goes on to further stipulate that the confined space must be checked for levels of oxygen, combustible gas (LEL gases), and any toxic gas specific to the industry. This must be done at four-foot levels, in any direction of travel, throughout the confined space. The levels were established because often gases stratify within a stagnant confined space. Heavier gases accumulate at the bottom while lighter gases gravitate to the top.

### **Monitoring oxygen**

---

Oxygen is of primary concern because it is fundamental to all processes. Without oxygen, workers cannot survive, yet, at the same time, you don't want combustion to take place. Oxygen is a concern at the low and high ends of the spectrum. The normal atmospheric oxygen concentration is 20.9 percent. If oxygen drops below the acceptable level of 19.5 percent by volume workers actions become labored, they have difficulty breathing, may get lightheaded, and if the concentration drops to severely low levels, death can result.

Oxygen can be reduced naturally in a confined space due to oxidation and/or bacterial activity. You may think if a little oxygen is good then more is better, but this is not the case. Elevated oxygen levels above 23.5 percent can increase the risk of enhanced combustion, which causes items that are normally not combustible to combust. Excessive oxygen enhances the combustion process as evidenced by the reaction you get when you turn up the oxygen on an oxy/acetylene torch.

It is for these reasons that the oxygen content in a confined space must remain between 19.6 percent and 23.4 percent in order for safe entry and occupation to commence.

### **Combustible gases**

---

The next category of gases addressed in the confined space standard is combustible gases. These gases need to be at minimum levels for obvious reasons. Accumulation of combustible gases provides fuel that when combined with oxygen and acted upon by an ignition source, results in an explosion. Combustible gases are measured in units called percent of the lower explosive limit, or LEL.

All combustible gases have their own unique LEL levels. For example, methane explodes at 5.0 percent by volume while pentane combusts at 1.5 percent by volume. This level equates to 100 percent LEL or the minimum level of gas needed to cause an explosion. A reading of 50 percent LEL would mean that you would have half of the concentration of combustible gas needed to cause an explosion.

The OSHA allowable level for combustible gas is 10 percent LEL, which is a very conservative level but it does indicate that a combustible source is available and levels need to be continuously monitored to ensure they do not increase.

### **Toxic hazards**

---

The third category of hazardous gases to consider is toxic gases.

During a confined space entry, one must first realize the type of space being entered. Vessels, tanks and digesters that previously contained chemicals can have trace residues that could be liberated in the process. Care must be taken to understand the processes of the business location where the welding or cutting is taking place.

Common industrial toxic gases include carbon monoxide and hydrogen sulfide. Carbon monoxide (CO) is a by-product of incomplete combustion and can be present in a confined space adjacent to a combustion source. Furthermore, carbon monoxide can be generated in the welding or cutting process due to the work being done. Hydrogen sulfide (H<sub>2</sub>S) is a by-product of decomposition and commonly appears in petroleum and waste water applications.

The toxic gas family is not limited to these two gases; there are many other industry- and process-specific chemicals that fit into this category. It is always a good practice to fully understand the industry you are serving and the potential toxic gases that could be present. Most multi-gas monitors accommodate a variety of toxic sensors that can be easily plugged in and calibrated to be gas-specific. Utilizing this capability customizes your gas monitor to address the industry-specific hazards at hand.

### **Proper balance**

---

Since the nature of welding introduces an ignition source into the space and the process can produce toxic gases and deplete oxygen, care should be taken to continuously monitor confined spaces prior to and during entry and occupancy. What you are aiming for is the proper balance of all gases within a confined space. Too much or too little of any gas can result in disaster.

When welding in confined spaces, a multi-gas monitor is as vital as protective gloves and a face shield. By including this critical tool in your toolbox, you will not only increase your level of safety, but you'll also enhance your peace of mind. You'll breathe easier because welding safety is more than just guarding against arcs and sparks.

### ***SIDEBAR: Before you light up...***

---

Before gas welding or burning is started in a confined space, OSHA recommends the following precautions be taken:

- Check all hoses for leaks.
- Don't allow compressed gas bottles inside of the confined space.
- Light torches only outside of the confined area.
- Test the confined area for an explosive atmosphere each time before taking a lighted torch into the confined space.

#### ADDITIONAL INFORMATION

Dave Kuiawa is sales manager, North America, for Industrial Scientific Corp. He has been with the company for 15 years serving in various capacities including manager of customer services. Dave can be contacted at (800) 338-3287 or [dkuiawa@indsci.com](mailto:dkuiawa@indsci.com).



A **bnp** WEBSITE  
media

Copyright © 2005 by BNP Media