

# NO ROOM FOR ERROR

To protect your personnel, avoid these common mistakes in monitoring confined spaces for toxic and explosive gases

By David Kuiawa

Since the passage of OSHA's Permit-Required Confined Space legislation (29 CFR 1910.146), safety and hygiene professionals are increasingly aware of the need to be absolutely sure of the content of gases in these potentially dangerous areas.

A permit-required confined space, as defined by OSHA (page 4,550, definitions, sections 1, 2, 3, and 4), is a confined space that has one of the following characteristics:

- Contains or has the 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 a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized safety or health hazard.

We all know that these spaces can take on many diverse forms, but the do's and don'ts remain the same. Here are a few commonly-held misconceptions about gas monitoring for confined spaces that could lead to dangerous consequences.

**"I just calibrated our gas monitor last month. It should still be accurate."**

Calibration is the cornerstone of any successful gas monitoring program. Unless you compare and adjust your instrument to a known concentration of gas before each use, you have no assurance of its accuracy.

OSHA points out that workers should be using a calibrated, direct-reading gas monitor. Unfortunately, OSHA makes no mention of calibration frequency. On this issue, they usually refer to the

manufacturer's recommendations.

Be safe. Contact the manufacturer of your instruments and set up your program according to their guidelines. For your protection, and the protection of your employer, always document calibrations and preserve these records in a log. The calibration log should be kept current and should include all the gas monitors used in your work. These records should be on file for no less than one year; retention for five years is advised.

**"I put the tubing into the space, turned on the sampling pump, waited the recommended time (for the unit to respond) and all my readings checked out OK."**

Monitoring the gases in one area of a confined space is a dangerous oversight. Some gases are heavier than air, some are lighter. The molecular weight of a gas determines where it will accumulate within a confined space.

Air has a molecular weight of approximately 28.8. Common gases like hydrogen sulfide and methane will stratify naturally at different levels. Hydrogen sulfide, for example, has a molecular weight of 34 — therefore we can expect it to accumulate closer to the floor. Methane will be present closer to the top of the space due to its molecular weight of 16. This is assuming, of course, the space has poor natural ventilation or has not been stirred up and the gases are allowed to stratify.

29 CFR 1910.146 (page 4,557, appendix B, section 4) confirms this by mandating that employees monitor the gas in four-foot intervals in every direction of travel. For vertical entries, this is easy. Simply use flexible tubing, start at

the top, and work your way down. For horizontal samples, a rigid probe at least four feet long will be needed to safely address the situation.

**"My gas checks at all levels showed no gas. We're done with this unit. Put it in the truck so we don't lose or break it."**

The pre-entry evaluation is only one part of totally ensuring your safety in confined spaces. Gas conditions may be satisfactory now, but what if conditions change? In some confined spaces, pipes can pose a real danger. Normally, these vessels move product from one area to another, safely. If a pipe would develop a leak, the results could be deadly. Without a gas monitor at your side, this potentially hazardous situation may go undetected until it is too late. Be safe: Always monitor gases before, continuously during, and before any re-entry into a confined space.

**"Our inerting operation looks like a success. Our instrument shows 1.2 percent oxygen and no LEL gases."**

This common assumption can prove fatal. If you are using most common gas monitors to evaluate the concentration of combustible gases (LEL) in an inert environment, you may be getting a false sense of security.

Gas monitors employing catalytic diffusion sensors are very effective in determining hazard potential because they operate on the fire triangle principle. When you remove one of the elements from the fire triangle, namely oxygen, no reaction takes place. The danger in this is that, if you have explosive amounts of gas in an inert situation, and oxygen is introduced, or if the gas were to leak out of that area, a hazard could result.

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Most LEL sensors will monitor combustible gases accurately down to 10 percent oxygen by volume. For inert situations, a 1:1 dilution tube can be used to add ambient oxygen to the sample.

One thing to keep in mind is that because we are diluting our sample 1:1 with ambient air, the combustible gas reading will have to be multiplied by 2. This will ensure accurate monitoring of the sample in question.

As a safeguard, OSHA specifies a monitoring sequence of oxygen, combustible gases (LEL), and any potential toxic contaminants in the confined space legislation 29 CER 1910.146 (page 4,551, section (ii)(c)). If your business deals with inert purge situations, contact the monitor manufacturer for the accessories to do the job correctly.

**"The manual says use urethane tubing for sampling, but it's so hard to work with. It really doesn't matter because our confined spaces are safe. We have been using this black neoprene hose for years and never detect any hazardous gas."**

Some reactive gases like chlorine, nitrogen dioxide, ammonia and styrene can be absorbed into the walls of sampling tubing. The longer the tubing, the more gas can be scrubbed from the sample. If this absorption takes place, little or no gas will get to the instrument's sensors, and the hazard will go undetected. Urethane tubing has very smooth walls that gases cannot adhere to. Advances in urethane tubing technology have yielded several flexible designs that are resistant to kinks. Therefore, the days of urethane tubing being hard to work with are long gone.

**“When I attach the sampling pump to our gas monitor and turn on the pump, as long as I can hear the motor running I am feeding the instrument a good sample.”**

With the flow monitoring technology today, it is easier than ever to ensure proper sampling of confined spaces. Sampling pumps with built-in flow monitors are precise and easy to use. Care should be taken to use only sampling pumps that monitor gas flow through the pump.

Most sampling pumps only monitor the vacuum pressure at the inlet of the pump, so pump assembly failures can go undetected. As you can see, this is a serious safety concern. Along with flow monitoring, audible and visual failure warnings are ideal for enhanced hazard recognition.

#### **Avoid deadly errors**

Keep in mind that confined spaces can turn deadly at any time. Always fol-

low your organization’s policies in these situations. Monitor before entry, continuously during confined-space work, and before any re-entry.

Check for gas accumulation at all levels within a confined space, and remember to pay close attention to inert situations. Always use the proper sample tubing for the gases you are monitoring, and make sure your gas monitor is receiving an adequate sample from the sampling pump.

Get to know your gas monitor in detail. Read the manual, watch the video, and do not hesitate to ask for help if you do not understand something. Because in confined spaces, the situation is deadly serious, and what you don’t know could hurt you.

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