Monitoring Confined Spaces
Putting the Pieces Together

Confined space safety doesn’t have to be puzzling. When the individual components of a gas monitoring program are in place, you will find a complete picture of how to safely enter and work in confined spaces.

Understanding the Confined Space

Gas monitoring in a confined space begins with knowledge of the space itself. Confined spaces are those places that are not designed for continuous human occupancy. However, they do have limited or restricted means of entry/exit so that a person can enter to perform periodic repair or maintenance work. Confined spaces include, but are not limited to, underground vaults, tanks, storage bins, manholes, pits, silos, process vessels and pipelines.

In addition to meeting these criteria, 29 CFR 1910.146 further defines a permit-required confined space as one that also 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; or contains any other recognized serious safety or health hazard such as unguarded machinery, exposed live wires or heat stress.

For each permit-required confined space, it is important to identify the possible gas hazards that could be encountered. In every case, OSHA states that before an employee enters a permit-required confined space, “the internal atmosphere shall be tested, with a calibrated direct reading instrument, for the following conditions in the order given: 1) oxygen content; 2) flammable gases and vapors; and 3) potential toxic air contaminants.”

Why oxygen first? Many monitors use a catalytic bead sensor to detect combustible gas. These sensors work by burning small amounts of the gas, which requires at least 10% oxygen in the atmosphere.

Dewatering Pumps

Allegro Industries’ line of confined spaces work equipment includes four models of dewatering and sludge pumps. Pumps offer continuous operation at low water levels and extended dry runs without overheating the motor. The low water model can pump down to 3/16-in. and includes synthetic rubber wear parts and vortex impeller for durability. All pumps and hoses feature fire-hose-style quick-connect fittings, and a V-ring to protect the shaft seal from abrasives.

Request 51 at www.psads.info.

Gas Monitor

RAE Systems Inc. introduces the QRAE II Pump, offering fast response times required for safe confined space entry. Full-featured device is a compact, one- to four-sensor toxic gas detector for oxygen, combustibles, hydrogen sulfide, carbon monoxide or sulfur dioxide. Features include easy-to-change battery pack, water-resistant case and solid-polymer electrochemical, lead-free oxygen sensor. Instrument is powered by either rechargeable lithium-ion or standard alkaline batteries. Large display can be flipped to the orientation of the worker for either handheld or belt-mounted operation. Unit features a visual graph display in addition to the actual sensor readings. Device has international certifications for use in hazardous environments such as oil refineries, petrochemical plants, steel mills, wastewater treatment plants, landfill operations, sewers and trenches.

Request 50 at www.psads.info.

Mulitgas Detector

BW Technologies introduces the GasAlertMicroClip, a portable multigas detector. Continuous LCD shows simultaneous gas concentrations for H₂S, CO, O₂, and combustibles. Compact, durable unit features one-button operation, and records TWA, STEL and maximum exposures to gas, and displays readings on command. Equipped with internal vibrating alarm for high noise areas, monitor provides 95 dB alarm tone and bright wide-angle alarm bars. Device features simple automatic calibration procedure and is fully compatible with the firm’s MicroDock II automatic test and calibration system.

Request 52 at www.psads.info.
Understanding the confined space is especially important when testing for toxic gases. Depending on the process involved, the type of facility, or where the space is located, different toxic gases may be present.

The most commonly encountered toxic gases in confined spaces are carbon monoxide and hydrogen sulfide. Others such as sulfur dioxide, nitrogen dioxide, chlorine and chlorinated dioxide are common to several industries. A thorough understanding of the facility and its processes is essential to determining which gases should be monitored.

**Establishing Procedures**

Before anyone enters the space, a preentry test must be performed. Usually, this is done with a motorized sampling pump that draws air from inside the space to the instrument through tubing or an extendable probe. Air samples must be taken every 4 ft in the direction of travel. This method ensures that no dangers from stratified gases are present. Gas stratification occurs because some gases are lighter or heavier than air. For example, hydrogen sulfide is heavier than air and tends to settle toward the bottom of a space. So, testing the air only at the entry point can give the entrant a false sense of security if s/he needs to perform work near the bottom. Testing the air in 4-ft increments provides a more accurate picture of how safe the confined space is.

Even after the confined space has been deemed safe for entry, conditions within the space can change unexpectedly. Therefore, the internal atmosphere must be monitored continually while the space is occupied. This potential for changing conditions also makes it necessary to perform the preentry test again anytime a worker leaves the space for longer than 20 minutes. Before reentering, the internal atmosphere of the confined space must be tested again and continually monitored as if the worker were entering the space for the first time.

Due to the potentially hazardous conditions within a confined space, the work should not be performed alone. A designated attendant should be present outside of the space the entire time that it is occupied. The attendant is present for one purpose—to ensure the entrant’s safety. Attendants must not be involved in any other tasks that may distract from this mission.

If the entrant is overcome by toxic gas or asphyxiated from a lack of oxygen, the attendant may call for assistance, ventilate the confined space or operate a nonentry, mechanical retrieval system. The attendant must also try to maintain contact with the entrant. Communicating with the entrant and gathering information about the incident may be helpful for the rescue team when it arrives.

Under no circumstances should the attendant enter the space to rescue the entrant. OSHA statistics show that 60% of all confined space fatalities occur from attempted rescues. All too often, the would-be rescuers become additional victims.

**Selecting a Gas Monitor**

Knowledge of the specific task will determine what type of gas monitor and accessories should be used. Many units are available with a four-gas configuration to monitor the most common gases (oxygen, combustibles, carbon monoxide and hydrogen sulfide). If your needs extend beyond this capability, other models can monitor up to six gases simultaneously. Many feature a broader range of gas sensors that are interchangeable. This flexibility may be needed in facilities that have a wider variety of potential gas hazards in their confined spaces.

Best Practices continued on page 36

---

**Confined Space Kit**

Prior to working in any confined space environment, it is essential to have the right tools to ensure safe entry. **Industrial Scientific’s MX6 iBrid Confined Space Kit** is designed to make that as simple as possible. Housed in a durable, easy-to-transport case, the kit contains everything needed to test the atmosphere before entering a confined space. Designed to meet various monitoring applications, device can be set up to detect from one to six gases, including options for PID and infrared sensors for combustible gases and carbon dioxide.

Request 54 at www.psads.info.

---

**Docking Station**

**Honeywell Analytics’ MicroDock II** is an automatic hands-free calibration and functional bump test/data-logging station designed to serve the needs of an industrial crew or emergency responder team. Unit accommodates up to 10 Honeywell XD (single gas) or X5 (five-gas with PID option) model gas detectors. Included Field Manager software simplifies recordkeeping, and stores and updates calibration data. Station operates via line power or set of four C-cell batteries. Additional self-contained docking modules can be added to a system via plug-in connections with no external pressure transducers or gas lines necessary.

Request 55 at www.psads.info.

---

**Training Video**

**Summit Training Solution’s Confined Space Entry: No Time For Error** training video/DVD features on-site footage and captivating graphics to grab employee’s attention and stress the importance of hazard awareness when working in or around confined spaces. Exposing the dangers of confined spaces, program provides workers with the knowledge of how to safely work within potentially hazardous conditions. Topics in this program include definition of a confined space; associated hazards; proper entry procedures, including permits, monitoring and PPE; and attendant responsibilities. Available in English and Spanish, program comes with 10 employee handbooks and facilitator guide.

Request 53 at www.psads.info.
Accessory Selection
Apart from the monitor itself, other accessories are needed, including sampling pumps, tubing and probes. Accessories are also available to ease the burden of gas monitor maintenance. For example, testing and calibration stations can handle these tasks with the push of a button. Some can even store or immediately print the calibration results to demonstrate compliance with safety requirements.

Automated docking systems go one step further. With these systems, a user simply “docks” the gas monitor at the end of a shift. From there, the instrument’s serial number is recognized and the system can perform any number of tasks. Based on a predetermined schedule, functions such as battery recharging, bump testing, calibrating and data downloading occur automatically. This frees workers and SH&E professionals from the more time-consuming and routine tasks of gas monitor maintenance.

A total cost of ownership program combines these automated maintenance tasks with automatic equipment rotation, reports and alert notifications. It completely shifts the responsibility for managing and maintaining gas monitors to the manufacturer. This reduces instrument downtime as well as the organization’s gas monitoring liabilities. It also eliminates the time and labor costs involved with ordering parts and making repairs. When all of these things are in place, employees can shift their focus to the company’s revenue-generating activities.

Safe Behavior
If having the right equipment is important, then having a workforce trained in using the equipment is even more important. Training and education are critical to developing safe confined space entry practices. Ideally, periodic reviews of training principles will emphasize safety and transform these practices into habitual behaviors.

After all, the best and most thoroughly maintained equipment cannot protect human life if the equipment is not used properly or is not used at all. Likewise, establishing safety procedures and guidelines will not protect workers if the procedures are not followed.

There are many reasons why unsafe work behaviors exist. In a demanding environment, workers may feel pressured to get more things done in less time, and with better results. These pressures can influence a worker to cut corners and take chances.

Other times, unsafe behavior can be attributed to an organization’s culture. If the company places only a superficial emphasis on safety, or if safe behavior is not rewarded, then the organization’s culture is affected. Sometimes, the problem stems from a lack of training. Training workers only for the maintenance or repair work to be performed in a confined space is like teaching a teenager how to operate a car without teaching the rules of the road.

On the other hand, experienced workers may take incremental risks, which develop into unsafe behaviors over time. They may gradually become complacent about safety or overconfident regarding the safety of a confined space. If they’ve never encountered a hazardous atmosphere in their work experience, they may assume that an accident will never happen.

Putting It All Together
When these recommendations are followed, the potential hazards of confined spaces can be significantly reduced. Once the confined space is understood, procedures are established, equipment is selected and safe behaviors are in place, safely entering and working in confined spaces may not be so puzzling after all.

Thomas Suski is marketing communications manager for Industrial Scientific Corp. (www.indsci.com), Oakdale, PA. The company provides safety and industrial hygiene equipment for use in potentially dangerous locations such as oil refineries, drilling operations, underground mining and tunneling and utilities.

Gas & Motion Detection
MSA’s ALTAIR 4 Multigas Detector for LEL, CO, H₂S and O₂ provides portable gas detection with optional MotionAlert feature should a user become disabled due to unforeseen hazards. When enabled, this feature will activate if the instrument does not detect motion for 30 seconds, and is ideal for confined space entry applications. InstantAlert feature also allows users to manually alert others to a potentially hazardous situation. Ribbed rubber housing provides secure grip and durability, while high-contrast display and three large, rubberized buttons enable easy operation in low-light conditions. Detector features vibrating alarm, 95 dB audible alarm, and ultra-bright alarm LEDs on top and bottom for maximum visibility.

Request 56 at www.psads.info.

Multigas Sensor
GfG Instrumentation’s intrinsically safe G460 is a rugged, compact instrument for simultaneous detection of up to six gases. Installed sensor options include infrared (NDIR) for CO₂ and PID for VOC measurements. Device offers automatic calibration, one-button operation, top-mounted display and interchangeable battery packs. Consequence-proof boot as well as the dust- and water-resistant housing protect the instrument in harsh environments. Datalogging and event logging are standard.

Request 57 at www.psads.info.

4-in-1 Monitor
Built around microsensor technology, the GX-2003 is RKI Instruments’ smallest personal four-in-one gas monitor with a built-in sample pump. Weighing only 11 oz, it can monitor the standard confined space gases (LEL combustibles, oxygen, CO and H₂S), and can also measure 100% volume methane and dynamically display either % LEL or % volume with its auto-ranging ability. Large LCD display shows all gas readings, battery level and current time, and will automatically backlight in alarm conditions. Unit also has a special bar-hole mode to facilitate locating underground gas leaks. Variable frequency alarm helps to pinpoint leak without looking at the display. Device continuously checks itself for sensor connections, low battery, circuit trouble, low flow and calibration errors.

Request 58 at www.psads.info.