

OXYGEN DEFICIENCY, THE SILENT KILLER

Injury or death due to oxygen deficiency is a common hazard in the petrochemical, refining and other industries, and confined spaces, if not properly monitored, can create hazards for workers and rescuers.

Toxic gas often is to blame when workers unnecessarily die due to asphyxiation in environments where the oxygen actually is depleted by gases such as nitrogen. In particularly tragic cases, other workers or first responders have died trying to rescue workers trapped in oxygen-depleted environments.

To prevent these incidents, OSHA, the National Institute for Occupational Safety and Health (NIOSH) and other federal/state agencies have implemented numerous regulations, required procedures and permit processes. They also provide extensive preventative educational literature and announce major enforcement actions.

OSHA investigations into worker deaths caused by oxygen deficiency or toxic gas almost always reveal a failure to install safety systems or utilize personal protective equipment and to follow the proper safety procedures – especially in confined spaces. Today's fixed oxygen-deficiency and toxic-gas monitoring systems are highly reliable, relatively easy to install and operate and offer simple maintenance. They provide excellent protection for employees, first responders and plant equipment.

Failing to provide a safe work environment can be costly in more than dollars and cents terms. First, there is a tragic loss of life that includes employees who are the primary victims as well as would-be rescuers. Then there is the cost of the investigation, corrective action, regulatory fines as well as major liability lawsuits that can completely drain a company both financially and in terms of staff business focus.

Oxygen Deficiency

Human beings normally breathe air that is 20.9 percent oxygen by volume under normal atmospheric pressure conditions. When the concentration of oxygen decreases even slightly by a little more than 1 percent to 2 percent, people immediately begin to feel the effects. Healthy individuals are unable to work strenuously and their coordination may be affected in oxygen environments of 15 percent to 19 percent. With the depletion of oxygen to a mix of only 10 percent to 12 percent, respiration increases, lips turn blue and judgment is impaired. Fainting and unconsciousness begin to occur at 8 percent to 10 percent oxygen. Death occurs in 8 minutes at 6 percent to 8 percent oxygen; recovery is possible after 4 to 5 minutes if

oxygen is restored. These values are approximate and may vary greatly depending on an individual's health, physical activity and the specific working environment that they encounter.

There are a variety of causes that lead to oxygen deficiency. Leaking materials from storage tanks, natural gas lines, process valves and more release gas that displaces oxygen in poorly ventilated areas or confined spaces. Decomposing organic matter, such as animal, human or plant waste, produces methane, carbon monoxide, carbon dioxide and hydrogen sulfide that displace or consume oxygen. Even corrosion, such as rust, or fermentation or other forms of oxidation will consume oxygen and pose a hazard.

Confined Spaces

Oxygen deficiency often occurs in confined spaces, which are defined as being large enough and configured so that a person can enter and perform assigned work. Confined spaces have restricted means for entry or exit, and they are not designed for continuous employee occupancy.

Some confined spaces are designated as “permit-required” areas. These areas have material with the potential for engulfment, and are configured so an employee or responder could be trapped or asphyxiated by inwardly converging walls. They have a floor that slopes or tapers to a smaller cross-section, or they may have any other recognized serious safety or health hazard.

Many confined spaces are easy to recognize, such as manholes, sewers, boilers, silos, vessels, vats, pipelines, tunnels, storage tanks, ship compartments and underground vaults. Other confined spaces are less obvious, including open-topped water and degreaser tanks, open pits and enclosures with bottom access. These confined spaces prohibit natural ventilation, are potential sources of gas generation and can prevent gases from escaping to cause a hazardous atmosphere.

Let's face it: If a work area isn't properly ventilated or hazardous materials are in use, then there is serious potential for oxygen-deficient or toxic gas conditions that could harm workers or rescuers. Explosive and toxic gases, including hydrogen sulfide and carbon monoxide, combined with a lack of oxygen, are the cause of most confined space accidents.

Heroic efforts by would-be rescuers who are overcome by oxygen deficiency or other toxic gases actually result in 60 percent of all fatalities. When an accident occurs, sound the alarm, get help and call the professionals. One accident victim is more

than enough. Do not attempt a rescue without knowing the hazard, understanding the required response and using the proper safety equipment.

Simple Prevention Steps

You can prevent oxygen-deficiency, toxic or combustible gas and confined space accidents. There are many companies that specialize in assessing hazardous working environments - even insurance companies often are willing to help. Suppliers of fixed safety monitoring systems and personal protective devices will generally share their years of experience with their customers.

All it will take is a couple of emails or phone calls and you will have information coming your way on fixed or personal gas detectors and many other devices designed to improve the safety of your plant or facility. Better yet, go to the Internet, because the information resources available today are more extensive than ever.

Safety monitoring equipment manufacturers also have the advantage of regularly discussing potential hazards in multiple industries. They see the same or similar hazards, problems and concerns at multiple companies and in many different plant settings. They can apply their expertise and past lessons learned in ways that you might not initially consider. It can save you headaches, time, money and lives.