

## Engineer's Notebook

## The Atmospheric Hazards of Confined Space...

### What is confined space?

NIOSH (National Institute for Occupational Safety and Health) defines confined space as “a space which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy.”

### What are the dangers associated with confined space entry?

Confined space entry can become a very dangerous and costly experience if one is not thoroughly trained on the associated hazards of this responsibility. Common concerns are: elevated noise levels, heat and cold stress, mechanical and electrical hazards, dust, engulfment potential, and of primary concern—atmospheric conditions. Generally, these locations have limited entry and egress and are not conducive to prolonged human occupancy without the use of proper procedures and safety equipment.

### What are the most common atmospheric conditions I should be concerned about?

Gases typically monitored in confined spaces reside in three categories: oxygen, combustibles, and toxic gases. Alarm levels are 19.5% for oxygen deficiency, 23.5% for oxygen enrichment, and 10% LEL for combustible gases. The normal volume of oxygen in ambient air is 20.9%. The two most commonly monitored toxic gases are carbon monoxide and hydrogen sulfide. Carbon monoxide is a by-product of inefficient combustion, and hydrogen sulfide is naturally generated from the decomposition of organic materials like grass, wood, and dead animal carcasses.

### Who should determine which gases to monitor in a confined space?

Determination of which gases to monitor in a confined space is typically the responsibility of a Safety Specialist or a Certified Industrial Hygienist.

### Look out for confined spaces — they're not all easy to identify!

Manholes, sewers, boilers, silos, vessels, vats, pipelines, tunnels, storage tanks, chip compartments, and underground vaults are identifiable and non-identifiable areas and can be classified as confined spaces. Open-topped water and degreaser tanks, open pits, and enclosures with bottom access are also confined spaces. All prohibit natural ventilation, are a potential source of gas generation, and can keep gases from escaping, causing a potentially hazardous atmosphere. These areas should be properly labeled and treated with caution. Confined space gas monitors can be hand-held, portable, or attached to clothing as personal monitoring devices.

### Key Gas Detection Definitions:

**Attendant:** An individual stationed outside a permit space that monitors entrants and performs all attendants' duties.

**Authorized Entrant:** An employee authorized by the employer to enter a permit space.

**Entry Permit:** A document established by the employer that authorizes an employee to enter a permit space. The entry permit defines the conditions under which the permit space may be entered; states the reasons for entering; lists the anticipated hazard of entry; and establishes the length of time that the permit remains valid. For entries where the individual is authorized, the entry does not assume direct charge of the entry, the entry permit lists the eligible attendants, entrants, and the individual who may be in charge.

**Hot Work Permit:** An employer's written authorization to perform operations which could provide a source of ignition.

**IDLH:** Immediately Dangerous to Life or Health—The maximum concentration of gas in PPM (parts per million) from which a worker could escape within 30 minutes without experiencing any escape-impairing or irreversible health effects.

**LEL/LFL:** Lower Explosive Limit/Lower Flammable Limit—The lowest concentration (air-fuel mixture) at which a gas can ignite. Concentrations below this limit are too lean to burn.

**UEL/UFL:** Upper Explosive Limit/Upper Flammable Limit—The highest concentration that can be ignited. Above that concentration, the mixture is too rich to burn.

A gas is only combustible between its LEL and UEL, but any concentration of combustible gas should be a concern. Lean mixtures can collect in an area and reach a combustible level, or rich mixtures can be diluted with air to become combustible.

**Oxygen-Deficient Atmosphere**—An atmosphere containing less than 19.5% oxygen by volume.

**Oxygen-Enriched Atmosphere**—An atmosphere that contains more than 23.5% oxygen by volume.

**PPM:** Part Per Million—Volume measurement for toxic gases.

**TLV:** Threshold Limit Value—Term used to signify limits in toxic gas exposure.

**TLV-STEL:** Short Term Exposure Limit—A 15 minute excursion at a toxic-specific pre-determined level never to exceed the TWA of the substance.

STELs shall not be more than 4 per day and should be separated by at least 60 minutes between successive exposures.

**TLV/TWA:** Time Weighted Average—The concentration for a conventional 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

The above information, definitions, and practices are guidelines. Always consult applicable federal (29 CFR 1910.146), state, and local codes and regulations prior to application.