

Glossary

Alarm is an audible, visual, or physical presentation designed to warn the instrument user that a specific level of a dangerous gas/vapor concentration has been reached or exceeded.

Alarm Set Point is the selected gas concentration level where an alarm is activated.

Alarm Relay Contact Rating - amount of current/power that can be switched with a particular relay.

Ambient Air is air to which the sensing element is normally exposed.

Asphyxiant - A gas for which the primary hazard is that of displacing/depleting oxygen below levels considered safe for normal respiration.

Background - The “normal environment” against which a sensor indication must be evaluated.

Calibration is the procedure used to adjust the instrument for proper response.

Calibration Gas is a gas of known concentration(s) used to set the instrument span or alarm level(s).

Ceiling - Maximum concentration for short period (usually between 5 and 30 minutes, each gas is different) usually four such exposures are allowed per day and average exposures must still be within the TWA.

Consumables are those materials or components, which are depleted or require periodic replacement through normal use of the instrument.

Cross-sensitivity refers to the response of a sensor to a gas other than the target gas (also called an interference gas).

Diffusion is a process by which the atmosphere being monitored is transported to the gas-sensing element by natural random molecular movement. This movement is accelerated by thermal energy.

Explosion-proof apparatus: Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within and that operates at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby.

Gas Concentration can be measured in three ways:

ppm (1% volume = 10,000ppm)

% by volume

mg/m^3 ($\text{mg/m}^3 = \text{ppm} \times \text{compound molecular weight}/24.45$)

Fail Safe. Any system that cannot fail in any mode without providing a directly observable indication of failure.

Consider an electrical relay with a set of contacts that are open when it is unpowered. If a power source and a light bulb are connected in series with the contacts, the lamp will glow when the relay is energized. If the goal of this system is to insure that the relay has power, then this system is said to be fail-safe. If the lamp, relay contacts, lamp power source relay coil, or the relay coil power supply fail, then the lamp extinguishes itself providing a directly observable foolproof indication of failure.

Flammable (Explosive) Limits. For gases or vapors that form flammable mixtures with air or oxygen, there is a minimum concentration of vapor in air or oxygen below which propagation of flame does not occur on contact with a source of ignition. There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur. These boundary-line mixtures of vapor or gas with air, which if ignited will just propagate flame, are known as the "lower and upper flammable limits" (LFL and UFL) or the "lower and upper explosive limits" (**LEL** and **UEL**), and are usually expressed in terms of percentage by volume of gas or vapor in air. LEL and LFL are different terms for the same concept and can be used interchangeably. In popular terms, a mixture below the lower flammable limit is too "lean" to burn or explode and a mixture above the upper flammable limit too "rich" to burn or explode.

Example: the lower explosive limit (LEL) for methane is 5.0% by volume. The upper explosive (UEL) limit is 15.0%. Therefore, only mixtures of between 5.0 and 15% methane in air will be combustible.

Gas is a phase of matter, which expands indefinitely to fill a containment vessel. Characterized by a low density.

IDHL (Immediately Dangerous to Life and Health) represents the maximum concentration level of a substance from which one could escape within 30 minutes without escape-impairing symptoms or any irreversible effects (For instance 300 ppm for Hydrogen Sulfide).

Interference Gas

An interferent is any gas other than the target gas that will cause a gas detecting sensor to give a signal. In the case of a combustible sensor, any combustible gas or vapor will cause a signal (cross-sensitivity).

Intrinsically safe apparatus: Apparatus in which all the circuits are intrinsically safe.

Intrinsically safe circuit: A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

Lower Explosive Limit (LEL)

Lower Flammable Limit (LFL)

The lower explosive limit (LEL) or lower flammable limit (LFL) of a combustible gas is defined as the smallest amount of the gas that will support a self-propagating flame when mixed with air (or oxygen) and ignited. In gas-detection systems, the amount of gas present is specified in terms of % LEL: 0% LEL being a combustible gas-free atmosphere and 100% LEL being an atmosphere in which the gas is at its lower flammable limit. The relationship between % LEL and % by volume differs from gas to gas. For data on other gases, refer to the most recent edition of the *Handbook of Chemistry and Physics* published by the C.R.C. Press. Typical settings for the alarm circuit are 20% for the low alarm, 40% for the high alarm and 60% for the high-high alarm.

The LEL of a gas is affected by the temperature and pressure: as the temperature increases, the LEL decreases and hence the explosion hazard increases; the relationship between LEL and pressure is fairly complex, but at approximately one atmosphere a pressure increase usually lowers the LEL. The LEL of a gas is not significantly affected by the humidity fluctuations normally encountered in the operation of a gas-detecting system.

NIOSH - National Institute for Occupational Safety and Health

Non-Intrusive Calibration – calibration can be achieved without opening the unit's enclosure, which would otherwise compromise the explosion proof rating.

OSHA: Occupation Safety & Health Administration, a government agency

PEL/TWA

"Permissible exposure limit" or "Time Weighted Average". This is the cumulative average concentration over an 8 hr/day, 40 hr/wk to which a worker can be safely exposed.

Peak

Maximum one-time exposure, usually 10 minutes. No other exposure is allowed even below the TWA.

PPM

Parts Per Million (1% exposure = 10,000ppm)

Percent by volume

Concentration of gas in a mixture expressed as a percentage of total volume.

Poisons - Gas detecting sensors can be quickly destroyed (or poisoned) by certain materials. Even low concentrations of poisoning substances can cause serious problems. The two most common phenomena are coating and etching of catalytic beads, and can be experienced when catalytic sensors are exposed to materials such as lead, silicones, or sulfur compounds.

Poison Resistant – coatings can be applied to sensor elements, making them more resistant to poisons.

Range is the series of outputs corresponding to values of concentrations of the gas of interest over which accuracy is ensured by calibration.

Relative Density relates the molecular weight of a gas to the molecular weight of air.
$$\frac{MW (GAS)}{MW (AIR)}$$

Relative density is the weight of a volume of pure vapor or gas (with no air present) compared to an equal volume of dry air, at the same temperature and pressure. This information assists in determining the optimum location of a gas detecting sensor. A vapor density figure of less than 1 indicates that the vapor is lighter than air and will tend to rise in a relatively calm atmosphere. A figure greater than 1 indicates that the vapor is heavier than air.

Repeatability - the figure which describes an instrument's ability to achieve the same result, in repeated tests.

Resolution - the smallest increment that is discernible as a discrete unit.

Response Time - the time in a test between input and observable meter response.

Span - full range of a sensor i.e. a CO sensor with a full scale of 0-100 ppm has a 100 ppm span.

TLV/TWA - "Threshold Limit Value" for the Time Weighted Average 8 hour day.

TLV/STEL - 15 minutes "Short Term Exposure Limit" which should not be exceeded at any time during the working day and not be repeated more than four times per day. STELs should exceed three times the TWA for no more than a total of thirty minutes and never more than five times the TWA even if the TWA is never exceeded. There should be at least 60 minutes between STEL exposure periods and TWA should not be exceeded.

TLV-C - Ceiling which should not be exceeded during any part of the working day.

TLV-IDLH - This is the concentration, which could be "immediately dangerous to life or health" and represents the maximum level from which one could safely escape within thirty minutes.

TWA/PEL - "Time Weighted Average" or "Permissible exposure limit". This is the cumulative average concentration over an 8 hr/day, 40 hr/wk to which a worker can be safely exposed.

Threshold Limit Value Time-Weighted Average (TLV-TWA) is the time-weighted average concentration of a substance for a normal 8-hour work day and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day.

Toxic Gas or Vapor - Any substance, which causes illness or death when inhaled or absorbed by the body. Hydrogen sulfide, chlorine and sulfur dioxide are highly toxic gases.

Zero - output at zero gas (4 mA on out transmitters)

Zero Gas - Zero gas is clean air, and is an excellent way of insuring that a small release of gas is not near the sensor while zeroing the sensor signal during calibration.

Zone - an area which is being monitored for which and alarm anywhere in the zone will cause the same result – i.e. if there are three sensors in “Zone 1” and if any of those sensors goes into alarm “Fan A” will turn on. If there were only one sensor per zone, the each would turn on its own fan.