Basic Considerations for Installing a Fixed System

1: To install it so that it will monitor every part of the area where a risk exists.

2: The system should give early warning of the presence and location of gas in order to initiate one or more of the following:

a) evacuation of the premises
b) fire fighting
c) shutdown of the process or plant
d) control of ventilation

There are no rules about detector location, however BS6959 clause 5.2 states: "Sensors should be located in positions determined by those who have knowledge of gas dispersion, the process plant systems and equipment involved and in consultation with both safety and electrical engineering personnel. The agreement reached on the locations of sensors should be formally recorded".

Protection must be provided by locating detectors adjacent to likely sources of hazard and at the perimeter of a plant. Both types should be used because localised detection can be affected by wind and its direction whilst perimeter detection gives a delayed response and protection for those entering an area.

After agreeing locations for gas detectors, the mounting height has to be decided. In general, for gases lighter than air the detectors should be above the area where leaks are likely and for gases heavier than air the detectors must be at floor level or in inspection pits or ducts into which heavy gases may flow.

However gases do not separate out into discrete layers according to their densities. If they did, air would not exist as a homogeneous mixture but the heavy carbon dioxide would be at ground level with oxygen, with a layer of nitrogen on top. It is better to view gases as tending to rise if they are light and tending to sink if they are heavy and to think about other influences which might affect the gas dispersion.

For example, if carbon monoxide, which is only slightly lighter than air, is under pressure and is suddenly released into the atmosphere a drop in temperature is caused resulting in an increase in density. This may cause the gas to fall to floor level.

Also, the nearer in density to air a gas is, the more easily it will flow with air due to draughts and ventilation etc. Therefore a compromise with gases like carbon monoxide and also gases only slightly heavier than air such as hydrogen sulphide and nitric oxide, is to mount the detectors at a height as close as possible to the breathing areas of personnel being protected.

When monitoring deficiency of oxygen, which is slightly heavier than air, it is necessary to consider what might be displacing it. For example carbon dioxide which is heavier will tend to sink to floor level so this is where the detectors should be. Conversely if helium is displacing the oxygen, the detectors should be mounted at a high level. On the other hand, if combustion is consuming oxygen, the whole volume of air would gradually become depleted in oxygen and detector location would not be so critical.

When installing gas detectors it is advisable to ensure that the gas inlet is not exposed to liquid or dust contamination by positioning the unit downwards (Splash deflectors should be used when water or other liquid is continually present).

People often ask what the area of coverage of a gas detector is in an open location. There is no official figure, but we often use 100m2 per detector, with more detectors at points where leakage could occur.

Molecular Weights of Gases and Their Ideal Sensor Positioning Height

Gas or Vapour	Molecular Weight	Open Area Sensor Position
Hydrogen	2.016	Highest Point
Helium	4.02	Highest Point
Methane	16.044	Highest Point
Ammonia	17.02	Highest Point
Water Vapour	18.02	Highest Point
Natural Gas	19	Highest Point
Neon	20.179	Head Height
Acetylene	26.04	Head Height
Carbon Monoxide	28.011	Head Height
Nitrogen	28.0134	Head Height
Ethylene	28.054	Head Height
Air	28.966	
Nitric Oxide	30.006	Head Height
Ethane	30.07	Head Height
Oxygen	31.9988	Waist Height
Sulphur	32.02	Waist Height
Methyl Alcohol	32.04	Waist Height
Hydrogen Sulphide	34.076	Waist Height
Hydrogen Chloride	36.461	Just below Waist
Hydrochloric Acid	36.47	Just below Waist
Fluorine	37.996	Just below Waist
Argon	39.948	Just below Waist
Propylene	42.08	Just below Waist
Carbon Dioxide	44.01	Just below Waist
Nitrous Oxide	44.012	Just below Waist
Propane	44.097	Just below Waist
Ethyl Alcohol	46.07	Just below Waist
Ozone	47.998	Just below Waist
Sulphuric Oxide	48.1	Just below Waist
Methyl Chloride	50.488	Just below Waist
Butadiene	54.09	Ankle Height
N-Butane	58.12	Ankle Height
Sulphur Dioxide	64.06	Ankle Height
Ethyl Chloride	64.515	Ankle Height
Chlorine	70.906	Ankle Height
Iso-Pentane	72.15	Ankle Height
Methyl Butane	72.15	Ankle Height
N-Pentane	72.15	Ankle Height
Carbon Disulphide	76.13	Ankle Height
Benzene	78.11	Ankle Height
Krypton	83.8	Ankle Height
Cyclohexane	84.16	Ankle Height
Hexane	86.17	Ankle Height
Toluene	92.13	Ankle Height
N-Heptane	100.2	Ankle Height
N-Octane	114.22	Ankle Height
Xenon	131.3	Ankle Height

Lighter than air

Heavier than air

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