

Detector Installation & Testing Methods



Sensors installation: general considerations

The following are some of factors that should be considered during the selection of the most appropriate sensor location:

- a) Areas and zones internal or external;;
- b) Possible sources: their localization and nature (e.g. the source density, pressure, volume, temperature and distance);
- c) The chemical-physical data of gas or vapor;
- d) The presence of low volatile liquids: in this case sensors must be placed close to the source;
- e) The typical nature and concentration of released gases (e.g. pressurized jets; slow losses; liquid drops);
- f) The presence of turbolences and vortices;
- g) The air motion:
 - ⇒ internal: natural and forced ventilation;
 - ⇒ external: wind speed and direction;

Sensors installation: general considerations

- h) Temperature effects, the environmental plant conditions;
- i) The number of person in the area and their location;
- k) The location of possible fire sources;
- l) The position of installed sensors that should not be exposed to bumps or water during normal operations;
- m) The sensor positioning must allow easy maintenance and calibration operations;
- n) Specific architectural settings (like walls, beams or panels) that facilitate the accumulation of gas and vapor;

Sensors installation: general considerations

Other issues

Usually, sensors should be installed on the air recirculation apertures, near the ceiling to detect light gases or near the floor in case of heavy gases.

If it is required to detect incoming gases or vapors from external sources, the sensors should be placed close to the air ventilation inlets. These sensors should add to the others eventually required for the detection of internal losses. In case the ceiling or the floor are partitioned with panels or other means, the sensors should be installed in any compartment.

Thermal induced flows generated by warm surfaces or equipment may influence the distribution of the gas-air mixture.

Sensors installation

□ Sensors installation

Sensors should be installed in any area where the gas may accumulate in a dangerous way. Such areas could be free of gas sources but with a reduced air circulation.

Heavy gases are likely to accumulate in wells and basins as the light gases cluster at high points. Sensors should be localized close to major gas sources even if, to limit false alarms, they should not be too close to machines with functional losses during normal operations.

In open spaces, reduced losses may vanish without causing dangerous accumulations. To detect gas losses from an area the sensors may be installed at regular intervals along the site boundary. Nevertheless, the simple monitoring of boundaries could be not enough to have the quick gas loss detection required when the release may cause severe damages to indoor objects or workers.

Sensors installation

□ Sensors installation

Sensors should be connected to their control units as for the manufacturer specifications (considering correct cables dimension, insulation etc.) and using proper cables, wires and connection systems or other systems approved for this aim and the areas classification. Verify that compounds used to lubricate threaded connections does not contain elements (e.g. Silicon) that may cause damages to sensors.

Often the sensor orientation may be specified by manufacturer. The project should include the evaluation of an appropriate draining to minimise the presence of wastes and condensations within the instrument, the sensing zone, cables or pipes.

Sampling systems filled with potentially explosive gases should be properly ventilated.

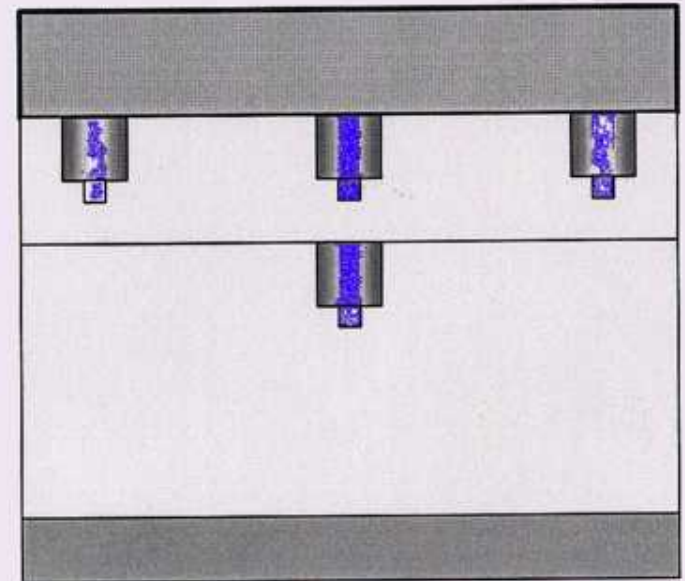
The localization: light gases

❑ *Conventional areas*

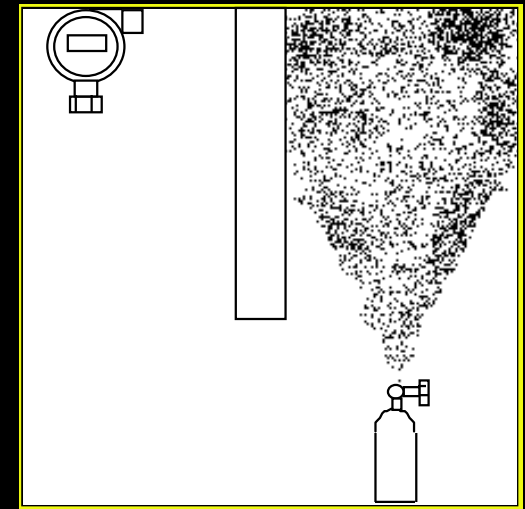
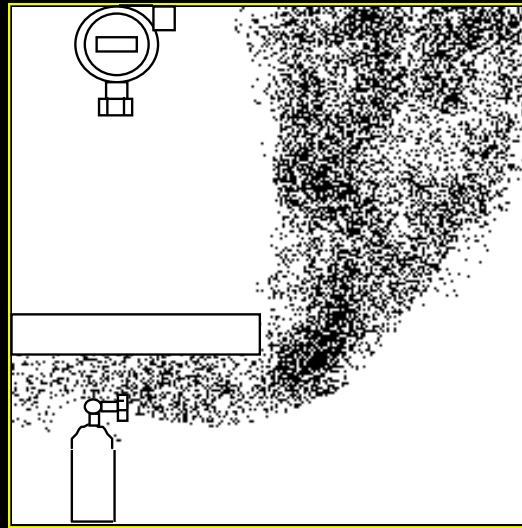
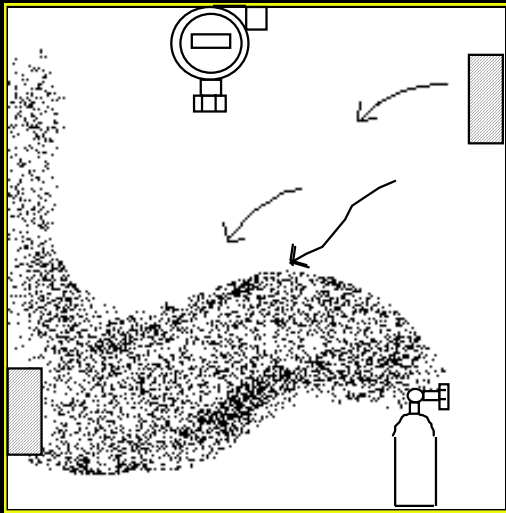
In areas not influenced by air flow the detectors may be installed at regular distances at near 30cm from the ceiling or along the boundary, if indoor work activities are not foreseen.

❑ *Flat ceilings*

Detectors must always be mounted on the top ceiling; in case a lower ceiling is present in the same room some detectors must also be installed on this.



Effects of Air Currents and Barriers

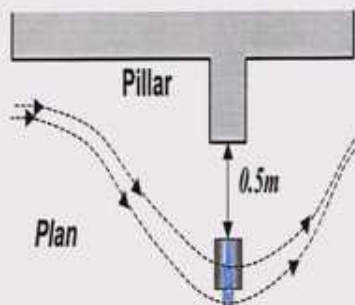


The localization: light gases

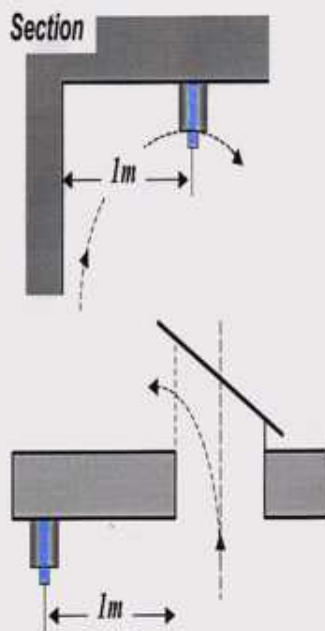
Areas with air flow

In principle, if an air flow greater than 0.5m/s is present, as in the case of spaces with heating or air fans, some precautions must be taken to avoid to place detectors in rested zones unless the gas leakage is there expected.

Smoke generators or the assistance of aeration specialists may be useful to optimize the air recirculation in the area.



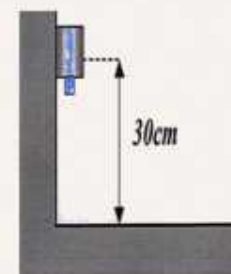
For the correct installation of gas detectors the following distance schemes should be observed.



The localization: heavy gases

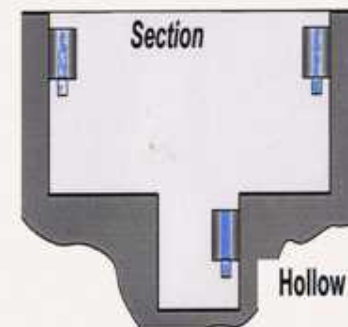
Conventional areas

Detectors should be installed close to the floor at about 30cm from it, side mounted on the wall, on columns etc. and set in the way that at least one is installed close to the potential gas leakage.



Areas with hollows or caves

The detector must always be installed at about 30cm from the bottom of the lowest floor or depression. Additional detectors shall be installed with the same criteria in hollows or caves.



Ventilated areas

If possible, the detector must be installed away from death zones without air circulation, unless gas leakage is there expected.

Number of detectors :



- The number of detectors required for an application depends on a number of factors:
- plant layout, air flow pattern, type of gas to be monitored, **degree of protection** ...



ATMOSPHERIC TESTING

INDUSTRIAL SCIENTIFIC

OLDHAM

Atmospheric Testing

Sample When / Where?

prior to entry

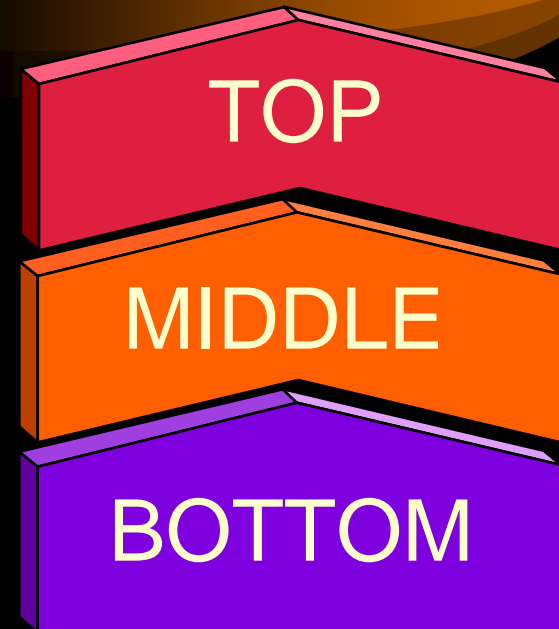
top, middle & bottom

continuously during entry**

prior to re-entry

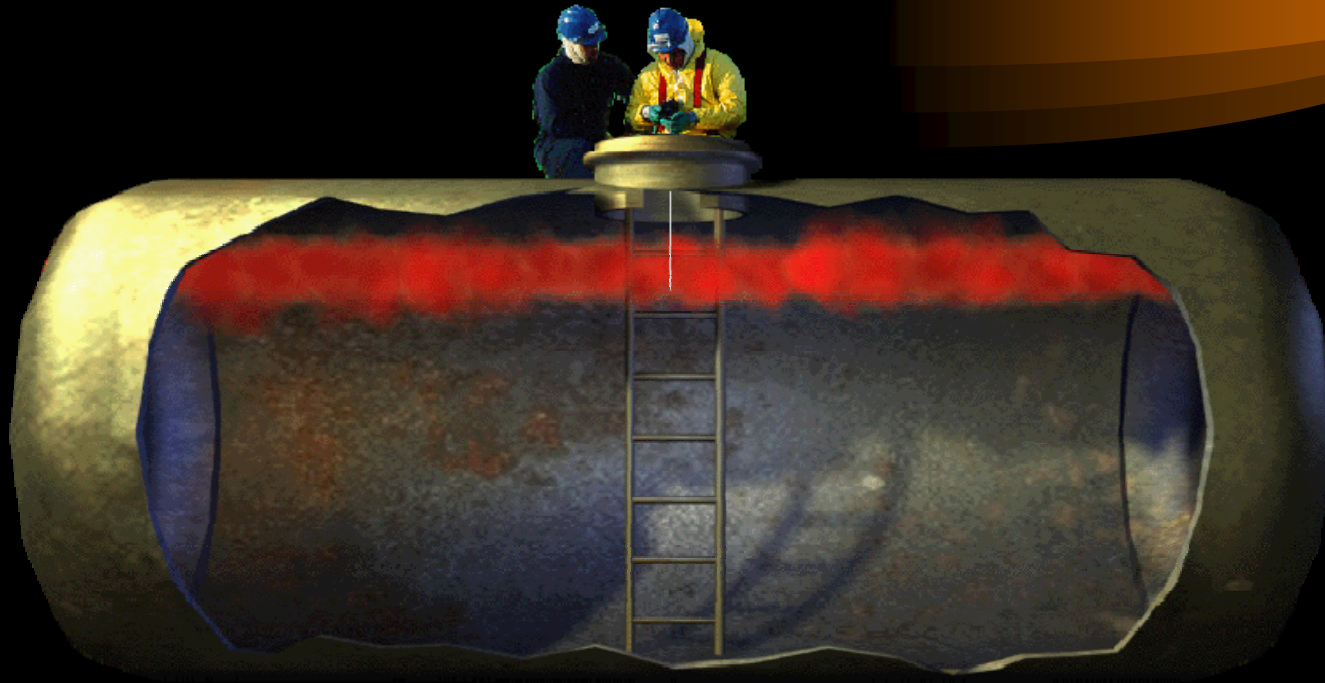
Sample Why?

stratification / weights / mix



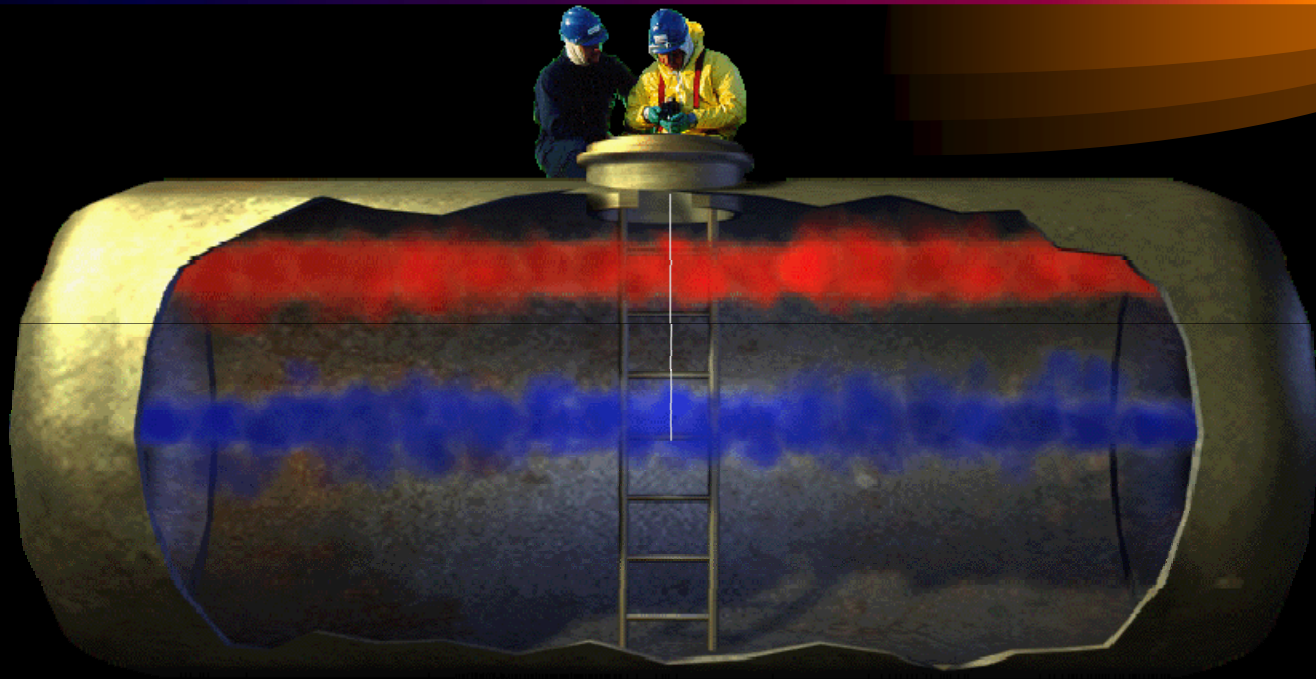
-There may be no hazardous atmosphere within the space whenever any employee is inside the space

Atmospheric Testing



METHANE (lighter than air)

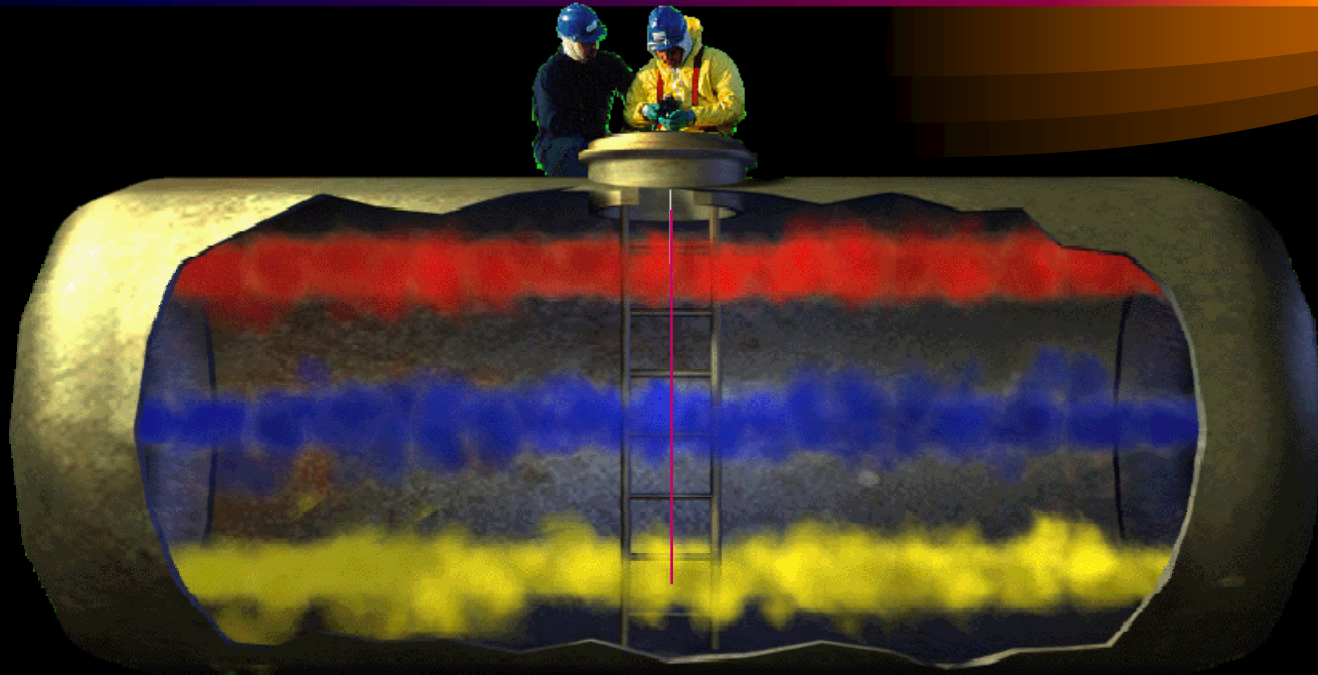
Atmospheric Testing



METHANE (lighter than air)

CARBON MONOXIDE (slightly lighter than air)

Atmospheric Testing



METHANE (lighter than air)

CARBON MONOXIDE (slightly lighter than air)

HYDROGEN SULFIDE (heavier than air)

Atmospheric Testing

-Before an employee enters the space, the internal atmosphere shall be tested for the following conditions in the order given:

Sample What?

- Oxygen content**
- Combustible Gases**
- Toxic Gases**

What Levels?

- 19.5 - 23.5%**
- 10% LEL**
- Depends on gas type**

Testing recommendations for gas monitoring instrumentation.

- How often gas monitoring instruments be tested and calibrated ?



Testing recommendations for gas monitoring instrumentation

- Gas monitoring instrumentation should be treated like any other piece of lifesaving equipment.
- It should be tested and calibrated on a regular basis.
- The safest approach to testing gas monitors is to function test or calibrate them prior to each day's use (mines ...) !

When it comes to testing and calibrating gas monitoring equipment ?

- Things to consider :
- Instrument use
- Abuse experienced in the field
- Gas exposures in fields (high levels)
- Operature use (shocks or abuse ...)



Testing recommendations for gas monitoring instrumentation

- A **function test** consists of exposing each sensor in the gas monitor to a known concentration of gas in excess of the lowest alarm set-point.
- The instrument should respond to the gas concentration by going into alarm
- If the sensors do not respond to the applied gas: the instrument will be calibrated ...
- A **calibration** has become a very simple, sometimes automated, process
- A **calibration** consists of exposing the instrument sensors to a known concentration of gas, making appropriate response adjustments to ensure the instrument it reading accurately :
 - zero setting in a pure air and span setting with a known concentration of gas.

Testing recommendations for gas monitoring instrumentation

- **ISC/OLDHAM** recommend a regular test according to the using : **before each day's usage sensitivity must be tested on a known concentration of gas**
- and a minimum interval of calibration every 6 months (industries) or every year (domestic market) .