

**NECESSITY OF O<sub>2</sub> AND CO  
DETECTORS in CONFINED  
SPACE JOB**

What gases and what percent of each make up normal air?

Nitrogen	78 %
Oxygen	21 %
Trace gases	1 %

# Specific Gravity:

- **The weight of a gas compared to an equal volume of normal air at the same temperature and pressure.**
- **Normal air has a specific gravity of 1.**
- **This determines where within a confined space, we will find concentrations of particular gases.**

# Specific Gravity:

- Molecular wt. Of CO – 28
  - Molecular wt. Of CO<sub>2</sub> – 44
  - Molecular wt. Of O<sub>2</sub> – 32
  - Molecular wt. Of N<sub>2</sub> – 28
  - Molecular wt. Of air – 28.9
- Specific gravity of any gas =  $M_{\text{gas}} / M_{\text{air}}$

# Examples:

<b>Gas</b>	<b>S.G.</b>	<b>Where Detected</b>
<b>Carbon Dioxide</b>	<b>1.529</b>	<b>floor to waist level</b>
<b>Hydrogen</b>	<b>0.0695</b>	<b>roof or ceiling</b>
<b>Oxygen</b>	<b>1.105</b>	<b>evenly distributed</b>
<b>Carbon Monoxide</b>	<b>0.967</b>	<b>evenly distributed</b>
<b>Sulfur Dioxide</b>	<b>2.264</b>	<b>floor</b>

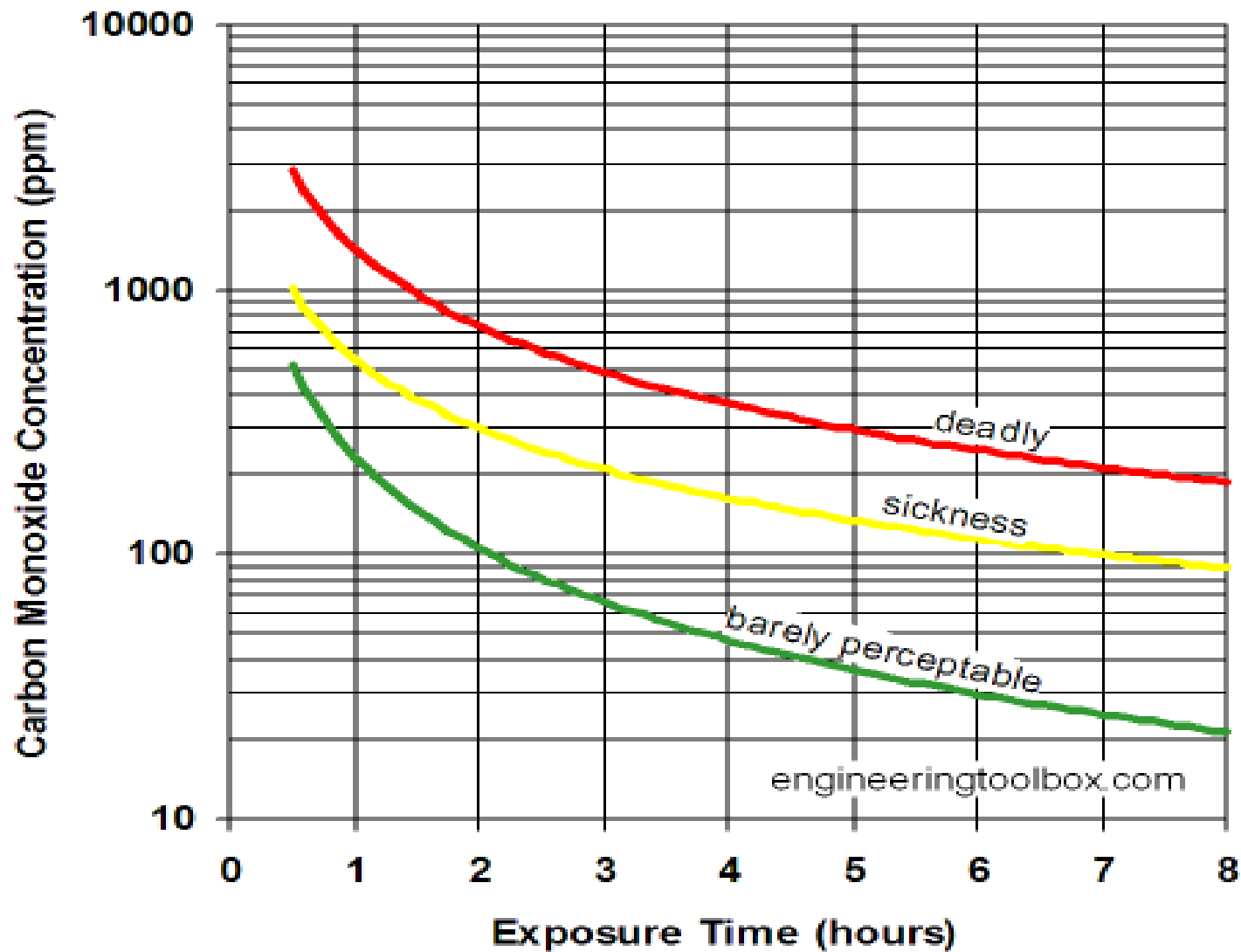
**Gases can and do pool**

**Gases tend to flow as fluids in  
quantity**

**These effects can displace  
Oxygen.**

<b>Exposure (hours)</b>	<b>CO Concentration (ppm)</b>		
	<b>Perceptible</b>	<b>Sickness</b>	<b>Deadly</b>
<b>0.5</b>	<b>600</b>	<b>1000</b>	<b>2000</b>
<b>1</b>	<b>200</b>	<b>600</b>	<b>1600</b>
<b>2</b>	<b>100</b>	<b>300</b>	<b>1000</b>
<b>4</b>	<b>50</b>	<b>150</b>	<b>400</b>
<b>6</b>	<b>25</b>	<b>120</b>	<b>200</b>
<b>8</b>	<b>251)</b>	<b>100</b>	<b>150</b>

1. The maximum exposure allowed by OSHA in the workplace over an eight hour period is 35 ppm.
2. A CO concentration of 12-13000 ppm is deadly after 1-3 minutes.





# MATHEMATICAL ANALYSIS

Case : Confined Space. Person takes only Oxygen Detector.

Air Quality : Nitrogen-78% Oxygen-21% Traces-1%

CO- 0 ppm

Oxygen Detector **shows OK.**

Due to CO leakage, CO concentration increases to 2000 ppm (0.2%)

In the worst case let this CO gas replace only Oxygen.

Air Quality Now: Nitrogen- 78% Oxygen-20.8% CO-0.2%

Oxygen detector **still shows OK**

Person dies after 30 min.

# CONCLUSIONS:

- CO is measured in ppm and Oxygen in percentage by the detectors because even a small amount of CO can pose hazard.
- Therefore even if the CO level increases beyond safe limits, it cannot show a noticeable change in Oxygen percentage and hence Oxygen detector alone cannot help.
- In confined space where there is no ventilation, the oxygen level slowly gets diminished and is occupied by carbon dioxide (which is generated as a result of breathing). In this case CO level might be well within limits. So a CO detector alone also cannot help.

- Therefore a low level of CO cannot ensure acceptable levels of Oxygen and vice versa.

- Therefore in confined space it is mandatory to carry Oxygen detector and if there is possibility of CO leakage (like the LD#2 gas pipeline cleaning job), then an additional CO detector should also be carried.

## How does CO poisoning work?

Red blood cells pick up CO quicker than they pick up oxygen. If there is a lot of CO in the air, the body may replace oxygen in blood with CO. This blocks oxygen from getting into the body, which can damage tissues and result in death.

