White paper Article

PPM to mg/m³

Converting reading units

Different regulation bodies use different types of units for different types of Workplace Exposure Limits (WELs). Parts Per Million (PPM) is used when a substance exists as a gas a vapour at standard atmospheric conditions where as mg/m³ is more commonly used for compounds that do not form vapours at standard atmospheric conditions, however gases and vapours can be expressed in both, as well a percentage (%)

PPM into mg/m³

All of ION Sciences PID based instruments give reading in PPM as standard, but sometimes other units are required. A conversion factor based on the molecular weight, the temperature and pressure where the measurement is taken is used, so every measurement taken will have a slightly different conversion factor.

Within the personal and portable Instrument sold by ION Science these calculations are done within the instrument software so no manual calculations are needed to convert the units.

However the fixed units only display in PPM so occasionally a manual calculation is needed, these calculations are displayed below to show how convert from ppm to mg/m³, and back again. The 2 numbers in the equations are based on standard conditions of 25 °C and sea_{-level} atmospheric pressure of 1 atmosphere. **(Please see next page)**

$$mg/m^3 = 0.0409 \text{ X Concentration (ppm) X Molecular weight (g/mol)}$$

An example of this would be, if our display shows we have 50 ppm of Ammonia at standard conditions we would use above calculation to convert ppm into mg/m^3.

$$mg/m^3 = 0.0409 \text{ X } 50 \text{ X } 17.03 = 34.83 \text{ mg/m}^3$$

However if our work exposure limit is only expressed in mg/m^3 and we need to know where to set an alarm in PPM; we use the below calculation again based at standard conditions.

$$ppm = \frac{24.45 \text{ X Concentration (mg/m}^3)}{\text{Moleculat weight (g/mol)}}$$

An example of this might be Diethyl Phthalate where the EH40 STEL is only given in as 10 mg/m^3 but we need to know what that is in PPM.

$$ppm = \frac{24.45 \text{ X } 10}{222.2} = 1.1 \text{ ppm}$$

PPM to Percentage %

The conversion from PPM to percentage and back again is slightly simpler, we may need to use these calculations when deciding what calibration gas to use, say we have a 1.2 % bottle of Isobutylene which we want to calibrate on our instrument on, if we want to know what this would be in ppm the below calculation would be used

$$ppm = \% \text{ X } 10{,}000$$

$$ppm = 1.2\% \text{ X } 10{,}000 = 12{,}000 \text{ ppm}$$

A good bottle of gas for SPAN 2 on our calibration curve, but we need a lower ppm bottle for the SPAN 1 and our gas supplier likes to receive orders in % rather than PPM so we would use the below calculation

$$\% = ppm \text{ X } \frac{1}{10{,}000}$$

Assuming we would like a 100 ppm bottle of gas we would calculate the % as

$$\% = 100 \text{ X } \left(\frac{1}{10{,}000}\right) = 0.01\%$$

References

1. CCOHS Candian Centre For Occupational Health And Safety (Obtained by website on 23/02/2021)

https://www.ccohs.ca/oshanswers/chemicals/convert.html

2. HSE Health And Safety Executive (Obtained by website on 23/02/2021)

https://www.hse.gov.uk/pubns/books/eh40.htm

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