

Common Expressions

Common Expressions for Aqueous Samples:

milligrams per litre (mg/L): Used to express results for aqueous samples, mg/L means: milligrams of analyte per liter of sample (e.g., 1milligram of copper per 1 liter of water).

Since 1 litre of pure water at 4°C weighs 1,000,000 milligrams, 1milligram per litre (1,000,000 mg) is commonly referred to as parts per million. Naturally occurring waters have greater density then pure water due to dissolved constituents, however this ambiguity is usually ignored.

micrograms per liter (ug/L): Used to express results for aqueous samples, ug /L means: micrograms of analyte per litre of sample (e.g., 1microgram of copper per 1 litre of water).

Since 1 litre of pure water at 4°C weighs 1,000,000,000 micrograms, 1microgram per litre (1,000,000,000 ug) is commonly referred to as parts per billion.

Naturally occurring waters have greater density then pure water due to dissolved constituents, however this ambiguity is usually ignored.

Units of Measure and Conversions

Chemical analysis results from environmental laboratories are measured and expressed in one of two ways:

1. mass/mass relationship (e.g., mg/kg for solid samples and non-aqueous liquid samples)
2. mass/volume relationship (e.g., mg/l for gaseous and liquid samples)

The amount of analyte is the first part of the expression; the mass or volume of the sample is the second part of the expression.

These expressions are frequently converted to the ambiguous terms, **parts per million (ppm)** or **parts per billion (ppb)** See "Common Metric Units" at the end of this section for more information.

Common Expressions for Solid and Non-aqueous Liquid Samples

milligrams per kilogram (mg/kg): used to express results for solid and non-aqueous liquid samples, mg/kg means: milligrams of analyte per kilogram of sample (1milligram of copper per 1 kilogram of soil).

Since 1 kilogram is made of 1,000,000 milligrams, mg/kg is commonly referred to as parts per million.

mg/kg is used for soil samples because unlike water, the volume of a soil sample is subject to many variables, making it impractical to determine consistently. The mass of a soil sample can be determined quickly and accurately using a balance. Results for non-aqueous liquids (solvents and oils) are expressed in mg/kg because their densities may vary significantly from that of water.

Results for soil samples can be reported as milligrams of analyte per kilogram of wet soil or milligrams of analyte per kilogram of *dry* soil. Dry weight results are preferred for some results because the soil moisture variable is removed from subsequent data interpretation. See "Dry Weight versus Wet Weight" at the end of this section for further explanations.

micrograms per liter (ug/L): used to express results for solid and non-aqueous liquid samples, ug /kg means: micrograms of analyte per kilogram of sample (1microgram of copper per 1 kilogram of soil).

Since 1 kilogram is made of 1,000,000,000 micrograms, ug/kg is commonly referred to as parts per billion.

ug/kg is used for soil samples because unlike water, the volume of a soil sample is subject to many variables, making it impractical to determine consistently. The mass of a soil sample can be determined quickly and accurately using a balance. Results for non-aqueous liquids (solvents and oils) are expressed in mg/kg because their densities may vary significantly from that of water. Results for soil samples can be reported as milligrams of analyte per kilogram of wet soil or milligrams of analyte per kilogram of dry soil. Dry weight results are preferred for some results because the soil moisture variable is removed from subsequent data interpretation. See "Dry Weight versus Wet Weight" at the end of this section for further explanations.

Common Expressions for Gaseous Samples

milligrams per cubic meter (mg/m³): used to express results for gaseous samples, mg/m³ means milligrams of analyte per cubic meter of sample (1milligram of benzene per 1 cubic meter of air).

The conversion of results from mg/m³ to parts per million by volume (ppmv) is not as straightforward as the similar conversion of results for liquid or solid samples. In order to express a result in parts per million, the units expressing the concentration of the analyte must be the same as the unit expressing the volume of the sample. For gaseous sample results, the mass of the analyte detected must be converted to its volume using standard conditions, the molecular weight of the analyte and the molar gas constant. mg/m³ is not

equivalent to ppmv. See "Air Conversions" at the end of this section for a presentation of the appropriate calculations.

Common Metric Units

Unit of Mass	Equivalent H ₂ O Volume *
kilogram, kg	liter, l
gram, g	milliliter, ml
milligram, mg	microliter, ul
microgram, ug	nanoliter, nl
nanogram, ng	picoliter, pl
* Pure water at 4 degrees Celsius	

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