1 Units and concentrations

1.1 Commonly used concentration units

Commonly, concentration units are presented using units in the form of mass per volume (e.g. milligrams per litre, mg/L, $mg.L^{-1}$) for water samples or mass per mass (e.g. milligrams per kilogram, mg/kg, $mg.kg^{-1}$) for sediment, soil or biota samples. However, units expressed as parts per a number (e.g. parts per million, ppm) may still be encountered.

The conversion of parts per number data to concentration units can be confusing. For this reason, a range of examples are provided in Table 1. Prefixes and multiplication factors used for the conversion of units are presented in Table 2.

Table 1: Conversion of the parts per number units to concentration units. Common concentration units used in environmental science

Parts per number units		Equivalent units mass per mass or mass per volume units				
Parts per thousand	‰	g/kg or $g.kg^{-1}$	mg/g or $mg.g^{-1}$	g/L or $g.L^{-1}$	mg/mL or $mg.mL^{-1}$	µg/µL or $µg.µL^{-1}$
Parts per million	ppm	mg/kg or $mg.kg^{-1}$	µg/g or $µg.g^{-1}$	mg/L or $mg.L^{-1}$	µg/mL or $µg.mL^{-1}$	ng/µL or $ng.µL^{-1}$
Parts per billion	ppb	µg/kg or $µg.kg^{-1}$	ng/g or $ng.g^{-1}$	µg/L or $µg.L^{-1}$	ng/mL or $ng.mL^{-1}$	pg/µL or $pg.µL^{-1}$
Parts per trillion	ppt	ng/kg or $ng.kg^{-1}$	pg/g or $pg.g^{-1}$	ng/L or $ng.L^{-1}$	pg/mL or $pg.mL^{-1}$	fg/µL or $fg.µL^{-1}$

1.2 Nutrient concentration conversions

Results from nutrient analyses can be reported in two ways – as the whole compound or as the principal element in the compound. For example, nitrate may be reported as nitrate (NO_3) or nitrate as nitrogen (NO_3-N). When assessing results against guidelines and standards, or when comparing data from different sources, it is important to compare like with like and convert the results if needed.

Table 2: Commonly used unit prefixes

Prefix	Symbol	Multiplication factor	Example
giga	G	10^9	Gigalitre (GL) = 1 x 10^9 L
mega	M	10^6	Megalitre (ML) = 1 x 10^6 L
kilo	k	10^3	Kilometre (km) = 1 x 10^3 m
deci	d	10^{-1}	Decimetre (dm) = 1 x 10^{-1} m
centi	c	10^{-2}	Centimetre (cm) = 1 x 10^{-2} m
milli	m	10^{-3}	Millilitre (mL) = 1 x 10^{-3} L
micro	µ	10^{-6}	Microgram (µg) = 1 x 10^{-6} g
nano	n	10^{-9}	Nanogram (ng) = 1 x 10^{-9} g
pico	p	10^{-12}	Picogram (pg) = 1 x 10^{-9} g
fempto	f	10^{-15}	Femptogram (fg) = 1 x 10^{-15} g

Example of conversions:

- 1 mg/L of nitrate NO_3-N = 4.43mg/L NO_3
- To convert mg/L NO_3-N to mg/L of NO_3 multiply result by 4.43
- To convert mg/L NO_3 to mg/L NO_3-N divide by 4.43.

Other conversion factors:

- 1.00 mg/L of nitrite as N (NO_2-N) = 3.28mg/L nitrite (NO2)
- 1.00 mg/L of ammonia (NH_3) as nitrogen (N) = 1.22 mg/L of ammonia as ammonia
- 1.00 mg/L of ammonium (NH_4) as nitrogen (N) = 1.29mg/L of ammonium as ammonium
- 1.000 mg/L of phosphate (PO_4) as phosphorus (P) = 3.066mg/L of phosphate as phosphate.

1.3 Conductivity units and abbreviations

The unit of measurement for conductivity is siemens (S) per unit of length of water that the current is passed through. Some common electrical conductivity (EC) unit expressions used for reporting conductivity are:

- microsiemens per centimetre (µS/cm or µS.cm^{-1})
- millisiemens per centimetre (mS/cm or mS.cm^{-1})
- decisiemens per metre (dS/m or dS.m^{-1})
- millisiemens per metre (mS/m or mS.m^{-1}).

The SI unit is millisiemens per metre (mS/m or mS.m^{-1}). Equivalence relationships among these units include:

- 1dS/m = 1mS/cm = 100mS/m = 1000µS/cm
- 1mS/m = 10µS/cm