



## URINE ELEMENTS

(ICPMS-derived reference intervals, reported as the molar metal/creatinine ratio)

ELEMENT	REF RANGE umol/mol creatinine	POPULATION MEAN umol/mol creatinine	COMMENTS
<b>ALUMINIUM (Al)</b>	< 130	34	Toxic; urine is the preferred specimen for monitoring Al exposure
<b>ANTIMONY (Sb)</b>	< 2.60	0.90	Toxic; increased level may reflect drug therapy. Respiratory and circulatory effects.
<b>ARSENIC (As)</b>	< 94	38	Toxic, sensitizing; urine As is the preferred specimen to diagnose toxicity Water, soil and fish contain non-toxic organic As. Inorganic As is a neurotoxic carcinogen, with adverse effects on fertility and foetal development.
<b>BARIUM (Ba)</b>	< 7.7	2.3	Toxic, sensitizing; high concentration in soil; toxic effects involve stimulation, followed by paralysis
<b>BERYLLIUM (Be)</b>	< 7.8	none	Toxic, sensitizing; CBD – chronic beryllium disease (skin rash).Urine is the preferred specimen for monitoring Be exposure
<b>CADMIUM (Cd)</b>	< 1.00	none	Toxic, sensitizing; blood is the preferred specimen to diagnose Cd toxicity. Carcinogen, can cause osteoporosis. Poorly handled by the kidney, may cause renal tubular damage.
<b>CHROMIUM (Cr)</b>	< 2.50	0.84	Nutrient; toxic at high levels and in certain valency states; chromium (VI) is carcinogenic.
<b>COBALT (Co)</b>	< 9.00	2.80	Nutrient, component of vitamin B12; toxic at high levels; a possible carcinogen and a myocardial poison in excess; stimulates erythropoiesis.
<b>COPPER (Cu)</b>	7 – 57	22	Nutrient; toxic at high levels; urine Cu does not reflect body status except at very high levels of intake
<b>LEAD (Pb)</b>	< 2.20	none	Toxic; blood is the preferred specimen to diagnose toxicity. Neurotoxic with adverse effects on fertility or foetal development.
<b>MANGANESE (Mn)</b>	< 5.00	1.80	Nutrient; toxic at high levels; sensitizing; Raised levels associated with cholestasis and Parkinsonian symptoms. Adverse effects on fertility or foetal development. Urine Mn is the preferred specimen for current over-exposure.
<b>MERCURY (Hg)</b>	< 2.00	none	Toxic, sensitizing; neurotoxic. Adverse effects on fertility or foetal development. Poorly handled by the renal tubule, mainly excreted by the biliary route. Blood is the preferred specimen for monitoring Hg exposure, but urine Hg increases on chelation challenge
<b>MOLYBDENUM (Mo)</b>	< 134	66	Nutrient; toxic at high levels; sensitizing; enzyme cofactor for sulphite, xanthine and aldehyde oxidases. Urine is the preferred specimen for monitoring Mo exposure
<b>NICKEL (Ni)</b>	< 27.2	7.1	Toxic, sensitizing; highly genotoxic carcinogen, but an essential co-factor for hydrogenases and certain other enzymes. urine is the preferred specimen for monitoring Ni exposure
<b>SELENIUM (Se)</b>	20 - 190	110	Nutrient; toxic at high levels (narrow therapeutic/toxic index)
<b>THALLIUM (Tl)</b>	< 0.42	0.19	Toxic; May be present in flue dust; from coal burning, and hence on home grown fruit and vegetables. Rodenticide. Can enter cells via K uptake pathways and high affinity for S may disrupt cellular organelles.
<b>TIN (Sn)</b>	< 15.3	4.8	Toxic, sensitizing; organic tin is more toxic than inorganic and is better absorbed. Lipophilic, affecting cell and organelle membranes. Carcinogen
<b>ZINC (Zn)</b>	17 - 1624	644	Essential nutrient. Urine levels decrease in deficiency and increase with excess intake, but the normal range is very wide

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