

DRIED URINE TEST SPECIFICATIONS

Mercury

Clinical Information

Mercury is a highly toxic heavy metal that can accumulate in body tissues including the brain. Besides occupational exposure, most human exposure to mercury is through dental amalgams, seafoods, and vaccinations. Mercury toxicity can cause nervous system damage, leading to symptoms such as paresthesia, mood changes, and sensory disturbances, while very excessive exposure can also lead to renal toxicity, respiratory failure and death. Mercury and selenium have a very high affinity for each other and form a tight complex; as a result, mercury reduces the biological availability of selenium and may inhibit the formation of selenium-dependent enzymes, affecting thyroid function in the same way as selenium deficiency. There are three forms of mercury in the environment: elemental, found in dental amalgams; inorganic compounds, primarily mercuric chloride, present in skin-lightening creams; and organic compounds, primarily methylmercury, found in seafoods. Elemental mercury is most commonly breathed in as a vapor and absorbed via the lungs, while inorganic and organic compounds are ingested and absorbed via the intestine. The predominant form in urine is inorganic mercury. Urinary mercury is an excellent biomarker for whole body exposure to both elemental and inorganic mercury.

Two dried urine samples are collected for mercury testing; first morning and last night. The mercury content is averaged for the two samples, which we have found to correlate excellently with results from a simultaneous 24-hour urine collection. Mercury levels are corrected using urinary creatinine to allow for variations in hydration status. The reference range is <1.58 µg mercury/g creatinine.

References:

Park JD, Zheng W. Human exposure and health effects of inorganic and elemental mercury. *J Prev Med Public Health.* 2012;45:344-52.
Branco V, Canário J, Lu J, et al. Mercury and selenium interaction in vivo: effects on thioredoxin reductase and glutathione peroxidase. *Free Radic Biol Med.* 2012;52:781-93.
Zava TT, Kapur S, Zava DT. Iodine and creatinine testing in urine dried on filter paper. *Anal Chim Acta* 2013;764:64-9.

Assay Method: ICP-MS

Intra-assay Precision

Intra-assay precision was determined by choosing three dried urine samples spanning the reference range for mercury, and analyzing them 20 times within the same run. Results are shown below:

Mean Mercury Concentration (µg/L)	Standard Deviation	Coefficient of Variation (C.V. %)
0.19	0.02	10.8
0.82	0.06	7.0
2.84	0.12	4.3

Inter-assay Precision

Inter-assay precision was determined by choosing three samples spanning the reference range for mercury, and analyzing them over a 1-month period. Results are shown below:

Mean Mercury Concentration (µg/L)	Standard Deviation	Coefficient of Variation (C.V. %)
0.21	0.04	20.4
0.87	0.06	7.4
2.84	0.19	6.7

Accuracy

To test the accuracy of the dried urine assay for mercury, external urine controls containing known concentrations of mercury were analyzed. Results are shown below:

External Control	Expected Mercury (µg/L)	ZRT Mercury (µg/L)
SeroNorm Trace Elements Level 1	0.096	0.004
SeroNorm Trace Elements Level 2	44	42.05
ClinChek Trace Elements Level 1	2.3	2.96
ClinChek Trace Elements Level 2	17.3	24.5
BioRad 400 Lyphocheck Metals Level 1	41.7	44.35
BioRad 405 Lyphocheck Metals Level 2	123	122.4
BioRad 376 Lyphocheck Level 1	15	14.42

Analyte Stability

The dried urine mercury samples are stable for more than one month at room temperature and for more than six months when stored at -80°C. Three freeze-thaw cycles did not cause a significant change in concentration.

Specimen Collection

Kits for dried urine collection contain two filter paper collection strips, easy-to-follow instructions, and a mailer to return the sample for analysis.