



## Toxic metals in children, 2016

In 2016, the monitoring was carried out in five localities – Prague, Liberec, Ostrava, Žďár nad Sázavou, and Kutná Hora. The target population were children aged five and nine years. The samples collected were 418 whole blood specimens, and 400 urine specimens. The whole blood and urine samples were analysed for selected toxic metals (cadmium – Cd, lead – Pb, mercury – Hg, and arsenic – As). The toxic elements were determined in mineralized (blood) and non-mineralized (urine) samples using inductively coupled plasma mass spectrometry (ICP-MS), with the exception of mercury, which was detected directly from the original samples using the AMA 254 advanced mercury analyzer. Blood and urine analyses were performed in the accredited laboratories of the National Institute of Public Health in Prague.

The total urinary **arsenic** level (median) varied between localities from 10.1 to 11.6 µg/l and was statistically significantly ( $p < 0.05$ ) lower in older children. According to the Agency for Toxic Substances and Disease Registry (ATSDR), the levels above 100 µg/l indicate elevated exposure [1]. This limit of 100 µg/l was exceeded in seven (2%) of 400 children.

The blood **cadmium** content is an indicator of current exposure. The median blood cadmium concentration in children varied between localities from 0.16 to 0.38 µg/l (median of 0.32 µg/l). These concentrations are comparable to those from previous years. The urinary cadmium content reflects long-term exposure. The median urinary cadmium concentration was lower than that found previously in 2008 and comparable to that obtained within the international project Democophes 2011 [2]. The health safety limit set by the German Biomonitoring Commission for urinary cadmium content (HBM I – 0.5 µg/l) [3] was exceeded in three children (0.58, 0.61, and 1.89 µg/l). The health safety limit HBM II of 2 µg/l was not exceeded in any child. The effect of age on the cadmium level was not clear.

The blood **lead** content (plumbemia) in Czech children has a downward trend since 2001 as a result of decreased lead emissions into the environment, mainly after the use of leaded petrol was prohibited. This trend continued even in 2016. The median blood lead concentrations in the localities monitored were 12.8 µg/l in boys and 11.5 µg/l in girls. The younger five-year-olds had significantly higher blood lead levels than the nine-year-olds (14.9 µg/l vs. 12.7 µg/l).

The blood **mercury** content is an indicator of recent exposure to organic forms of mercury (methylmercury) while the urinary mercury levels indicate long-term exposure to mercury, in particular to its inorganic forms and vapours. The blood and urinary mercury concentrations found in children do not exceed the limit HBM values (HBM I = 5 µg/l blood; HBM I = 5 µg/g creatinine) [3] and thus do not pose an increased health risk. No significant age related difference was observed. Similarly to previous years, the effect of the consumption of seawater and freshwater fish on the blood mercury content was confirmed. The consumption of fish should not be discouraged, but the species with lower contamination levels should be preferred. A positive correlation was observed again between the number of dental amalgam fillings and urinary mercury level in children.



**Tab. 1 Toxic metals in children's blood, 2016**

	Cd	Pb	Hg
Number of children	418		
	$\mu\text{g/l}$		
Geomean	0.304	12.3	0.321
Median	0.317	12.4	0.370
25 <sup>th</sup> Percentile	0.221	9.65	0.210
75 <sup>th</sup> Percentile	0.451	15.3	0.508
95 <sup>th</sup> Percentile	0.676	25.5	1.03
Minimum	0.030	3.81	0.090
Maximum	0.859	61.1	3.08

**Tab. 6.1.2 Toxic metals in children's urine, 2016**

	As	Cd	Hg
Number of children	400		
	$\mu\text{g/l urine}$		
Geomean	11.5	0.096	0.276
Median	10.4	0.096	0.28
25 <sup>th</sup> Percentile	7.29	0.065	0.2
75 <sup>th</sup> Percentile	14.8	0.155	0.38
95 <sup>th</sup> Percentile	54.0	0.355	1.18
Minimum	1.85	0.025	0.1
Maximum	248	1.89	4.23
	$\mu\text{g/g creatinine}$		
Geomean	11.6	0.097	0.28
Median	9.91	0.092	0.262
25 <sup>th</sup> Percentile	7.17	0.064	0.163
75 <sup>th</sup> Percentile	16.1	0.142	0.417
95 <sup>th</sup> Percentile	47.1	0.332	1.3
Minimum	3.67	0.015	0.035
Maximum	238	1.39	4.28



#### References:

- [1] Agency for Toxic Substances and Disease Registry (ATSDR) (2007). Toxicological Profile for Arsenic. Dep Heal Hum Serv Public Heal Serv.
- [2] Forysová K., Pinkr-Grafnetterová A., Malý M., et al. (2017). Urinary Cadmium and Cotinine Levels and Hair Mercury Levels in Czech Children and Their Mothers Within the Framework of the COPHES / DEMOCOPHES Projects. *Arch Environ Contam Toxicol*: 1–10.
- [3] Commission H.B. (2015). Human-Biomonitoring (HBM) values for blood and/or urine. <http://www.umweltbundesamt.de/en/topics/health/commissions-working-groups/human-biomonitoring-commission/reference-hbm-values> (Available 30.6.2017).