Table S1. Modified Ottawa-Newcastle Scale for cross-sectional studies.

Sample selection Criteria (6 stars)																			
1) Representativeness of the sample: a) Truly representative of the average in the population** (all subjects or random sampling); b) Somewhat representative of the average in the target population* (non-random sampling); c) Selected group of subjects; d) No description of the sampling strategy																			
2) Sample size: a) Justified and satisfactory*; b) Not justified.																			
3) Non-respondents: a) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory*; b) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory; c) No description of the response rate or the characteristics of the responders and the non-responders.																			
4) Ascertainment of the exposure: a) Validated measurement tool **; b) Non-validated measurement tool but the tool is available or described*; c) No description of the measurement tool.																			
Comparability (4 stars)																			
1) Comparison group: a) Described by authors as separate from exposure (i.e. different community/location)*; b) Described by authors as community exposure within the same location*; c) No comparison group.																			
2) The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled: a) The study controls for the most important factor (select one)*; b) The study controls for any additional factor *.																			

Outcome (1 star)																			
2) Statistical test: a) The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value)*; b) The statistical test is not appropriate, not described, or incomplete.																			
Total (11 stars)																			

Table S2. Results of data extraction from study set for Co, Cr, Mn, and Mo biomarkers in blood, serum, plasma, urine, and hair.

Element		Chromium							Cobalt					Manganese							Molybdenum				
Biomarker		**Blood (μg/L)**	**Serum (μg/L)**	**Plasma (μg/L)**	**Urine (μg/g)**		**Hair (μg/g)**		**Blood (μg/L)**	**Serum (μg/L)**	**Urine (μg/g)**	**Hair (μg/g)**		**Blood (μg/L)**	**Serum (μg/L)**	**Plasma (mM)**	**Urine (μg/g)**	**Hair (μg/g)**	**Blood (μg/L)**	**Serum (μg/L)**	**Urine (μg/g)**	**Hair (μg/g)**	
Ref values		**0.95[a]**	**2.7[a]**	**N/A**	**1.0[4]**		**0.12[5]**		**0.38[6]**	**N/A**	**0.16-1.14[6]**	**0.004-.014[7]**		**14-16[6]**	**N/A**	**0.63-2.26[d]**	**0.11-1.32[6]**	**0.02-0.57[7]**	**1.6[6]**	**2.2[4]**	**170[6]**	**0.01-0.03**	
Authors	**n**	**Med**	**GM**	**Med**	**Mean**	**GM**	**Med**	**Mean**	**GM**	**GM**	**Med**	**GM**	**GM**	**Med**	**Mean**	**GM**	**GM**	**Med**	**GM**	**Mean**	**GM**	**Mean**	**GM**	**Med**	**GM**	**GM**	**Med**	**Mean**	**GM**
Asante et al, 2012[2]	20				19	15							1.6								3.47				83.7		
	25				8.3	2.2							0.61								2.54				38.9		
	3				19	18							0.85								4.05				53		
Dartey et al., 2017	64		<LOD			0.25			1.2	0.2	0.59			9.5	0.8				1.1	1.5	96						
	64		0.7			0.23			2.6	0.2	0.61			8.1	1				1.1	1.5	87						
	65		<LOD			0.28			2.1	0.2	0.61			8	0.8				1	1.4	118						
	26		<LOD			0.34			2.1	0.5	1.5			10.3	0.8				1	1.3	75						
Ha et al., 2009	5							0.29					0.09					1.16									0.04
	6							0.4					0.05					1.86									0.07
	8							0.42					0.11					2.11									0.03
Julander et al., 2014[3]	53	1.4		0.81		0.74			0.08		0.25			11					0.97		74						
	10	1.1		0.3		0.71			0.06		0.24			8.8					0.69		44						
	25	0.85		0.31		0.24			0.07		0.21			9.4					0.49		58						
	7	0.58		0.29		0.23			0.02		0.19			9					0.47		41						
Li et al., 2014	30															1.15											
	28															0.23											
Srigboh et al., 2016	58				0.9	0.9					0.9			7													
	11				2.1	2.3					4.2			8.5													
Tokumaru et al., 2017	56						0.78					0.17						7.11							0.1		
	10						0.87					0.17						2.87							0.01[1]		
Wittsiepe et al., 2017	72				0.51	0.34																					
	40				0.3	0.23																					

[1] Note that $n = 1$. [2] Urine reported in (μg/L) with no adjustment for creatinine or specific gravity. [3] Urine sample concentration corrected using specific gravity. N/A indicates that no suitable reference or comparison value was found in the literature. [4] 95th percentile reference value from unexposed referent group in occupational study. [5] Median value of healthy referent population in occupational study. [6] 95th percentile reference value from a healthy Canadian population.[7]Proposed reference range.