

Supplementary materials

## HBM4EU chromates study - overall results and recommendations for the biomonitoring of occupational exposure to hexavalent chromium

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Supplementary Table S1: Analytical methods for the analysis of Cr in the different matrices. All the laboratories had passed the HBM4UE quality assurance (QA) program for blood and urine Cr analysis. For EBC-Cr(VI) analysis internal interlaboratory comparison was set-up among the analyzing laboratories. No interlaboratory comparison was put in place under HBM4EU for industrial hygiene samples, but laboratories analyzing samples were either participating in external QA or had in-house quality control.

	Blood (RBC)	Urine	EBC-Cr(VI)	Air (Cr(VI))	Wipe
Belgium	ICP-MS	ICP-MS	.. <sup>a</sup>	ICP-MS	ICP-MS
Finland	ICP-MS	ICP-MS	LC-ICP-MS	ICP-MS	ICP-MS
France	ICP-MS	ICP-MS	LC-ICP-MS	LC(IC)-UV/Vis	ICP-MS
Italy	ICP-MS	ICP-MS	IC-ICP-MS	ICP-MS	ICP-MS
Luxembourg	ICP-MS	ICP-MS	.. <sup>a</sup>	ICP-MS <sup>c</sup>	ICP-MS
Poland	ICP-MS	ICP-MS	.. <sup>a</sup>	ICP-OES/ICP-MS-HPLC	.. <sup>a</sup>
Portugal	GFAAS	GFAAS	.. <sup>a</sup>	UV/Vis	ICP-MS / IC
The Netherlands	ICP-MS	ICP-MS	micro-LC-ICP-MS <sup>b</sup>	ICP-MS / IC	ICP-MS / IC
UK	.. <sup>a</sup>	ICP-MS	micro-LC-ICP-MS	ICP-OES <sup>c</sup>	ICP-OES

<sup>a</sup> These samples were not collected or included in analysis. <sup>b</sup> Analysis carried out in UK. <sup>c</sup> Only total Cr was analysed.

Abbreviations: ICP-MS, inductively coupled plasma - mass spectrometry; LC, liquid chromatography; IC, ion chromatography; UV/Vis, ultraviolet-visible spectrometry; GFAAS, graphite furnace atomic absorption spectrometry; ICP-OES, inductively coupled plasma - optical emission spectrometry.

Supplementary Table S2: Work distribution of the participants of the HBM4EU Chromates study by country.

	Belgium	Finland	France	Italy	Luxembourg	Poland	Portugal	The Netherlands	UK	Total
	n	n	n	n	n	n	n	n	n	n
Bath plating workers	8	18	20	6	0	0	5	19	14	90
Chromate paint applications	15	0	0	4	0	1	32	0	0	52
Machining workers	9	2	19	0	0	0	5	0	3	38
Welders	28	25	18	38	16	51	3	0	16	195
Thermal spraying	0	5	0	0	0	0	0	0	0	5
Steel production	11	0	0	0	0	0	0	0	0	11
Maintenance and laboratory workers	0	0	1	0	0	0	5	1	1	8
All exposed workers	71	50	58	48	16	52	50	20	34	399
Within company controls	37	10	24	35	8	19	2	12	0	147
Out with company controls	0	16	0	0	0	0	25	0	15	56
All controls	37	26	24	35	8	19	27	12	15	203
All participants	108	76	82	83	24	71	77	32	49	602

Supplementary Table S3: Total number of samples received from exposed workers and controls in each country disaggregated by sample type.

	Cr analysis	Belgium	Finland	France	Italy	Luxembourg	Poland	Portugal	The Netherlands	UK	Total
Urine (exposed workers <sup>a</sup> / controls)	Cr	60 / 19	50 / 26	56 / 24	48 / - <sup>b</sup>	13 / 8	52 / 19	50 / 27	20 / 12	34 / - <sup>b</sup>	383 / 135
Blood (exposed workers / controls)	Cr	64 / 31	40 / 25	56 / 22	47 / 31	16 / 8	52 / 19	50 / 27	20 / 12	- <sup>b</sup>	345 / 175
EBC (exposed workers <sup>a</sup> / controls)	Cr(VI)/Cr(III)	- <sup>c</sup>	33 / 25	55 / 22	33 / 25	- <sup>b</sup>	- <sup>b</sup>	- <sup>c</sup>	20 / 11	34 / 15	175 / 98
Air Inhalable Outside RPE	Total Cr	26	41	4	33	6	50	- <sup>d</sup>	- <sup>d</sup>	18	178
	Cr(VI)	- <sup>d</sup>	34	43	33	- <sup>d</sup>	50	14	20	- <sup>d</sup>	194
Air Inhalable Inside RPE	Total Cr	2	10	- <sup>d</sup>	- <sup>b</sup>	6	1	- <sup>b</sup>	- <sup>b</sup>	16	35
	Cr(VI)	- <sup>d</sup>	3	7	- <sup>b</sup>	- <sup>d</sup>	1	- <sup>b</sup>	- <sup>b</sup>	- <sup>d</sup>	11
Air Respirable Outside RPE	Total Cr	20	41	- <sup>d</sup>	- <sup>b</sup>	5	- <sup>b</sup>	14	- <sup>d</sup>	18	98
	Cr(VI)	- <sup>d</sup>	34	37	- <sup>b</sup>	- <sup>d</sup>	- <sup>b</sup>	- <sup>d</sup>	20	- <sup>d</sup>	91

Wipes <sup>e</sup>	Total Cr	29	41	50	33	15	- <sup>b</sup>	45	20	34	267
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<sup>a</sup> Number of post-shift samples (number of pre-shift samples vary in some countries).

<sup>b</sup> Samples not collected.

<sup>c</sup> Although EBC samples were collected in Belgium and Portugal, they were not included in the data analysis due to quality concerns.

<sup>d</sup> Not determined.

<sup>e</sup> Number of workers sampled. Each worker provided 2-6 wipe samples each.