

Occupational Medicine & Health Protection
Chief Medical Officer: Prof. Dr. Stefan Lang

Human Biomonitoring (HBM)

Industry Perspectives and Practice

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Human Biomonitoring
Occupational Medicine & Health Protection
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General Statement on HBM in Occupational Medicine

German Chemical Industry Association (VCI)

VCI Position on Biomonitoring, June 1, 2005



The chemical industry is convinced of the benefits of adequately performed biomonitoring studies to occupational safety and health protection.

- „...has been **internationally established** for decades...“
- „...is a **valuable method** in occupational medicine to protect individual persons against the effects of harmful substances...“
- „...forms part of the **preventive health checks**...“
 -  Germany: Ordinance on Occupational Health Care
- „...constitutes part of the **tasks of company physicians**...“
 -  Germany: Act on Safety at the Workplace

Ordinance on Occupational Health Care (ArbMedVV)

Biomonitoring is a part of preventive occupational health care

insofar as **analytical methods** recognized by occupational medicine

and suitable **evaluation values** are available.

Central Trigger Criteria

CMR classification

skin notation

bioaccumulation

protective equipment essential for health protection

HBM may not be carried out against the worker's will.

right of informational
self-determination

⇒ HBM not mandatory!

source: https://www.bmas.de/SharedDocs/Downloads/DE/PDF-Gesetze/arbmed-vv-en.pdf?__blob=publicationFile

HBM Practice in the chemical industry (I)

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Occupational Medical
Health Examinations



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Non-Routine Operations:
maintenance, repair,
overhaul (turnaround)



additional exposure analysis
& risk assessment

Product Release
Chemical Incidents



additional exposure analysis
& risk assessment

Scientific Evaluation
Research & Development



improvement (concepts, practice)
participation in the scientific discourse

HBM Practice in the chemical industry (II)

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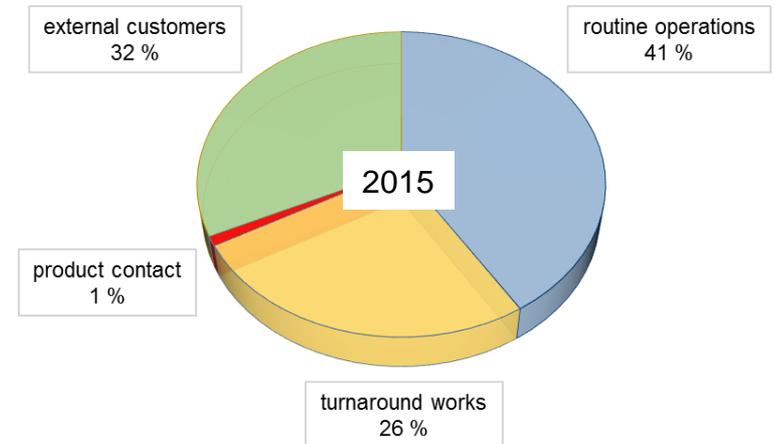
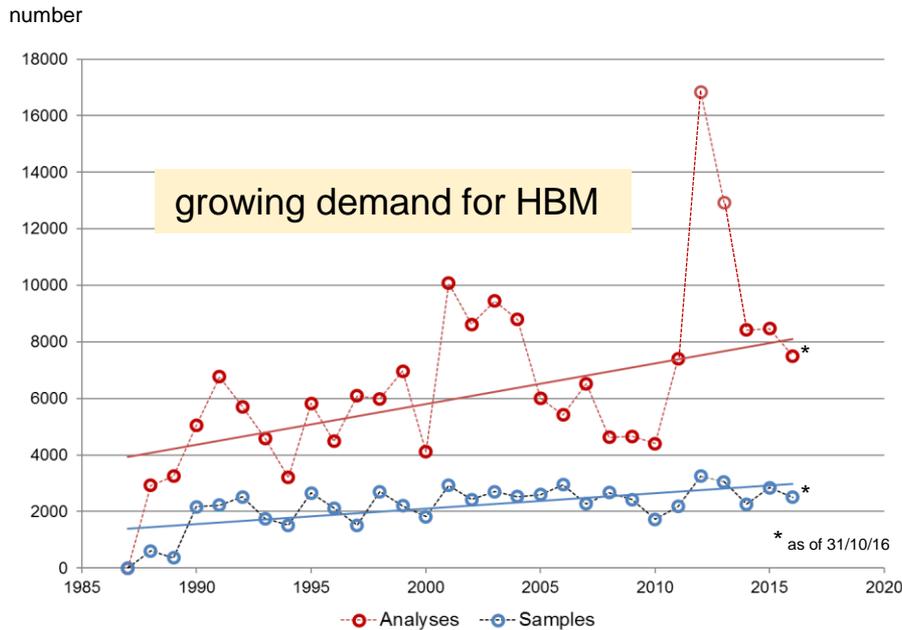
HBM laboratory since 1987

93 biomarkers

regular participation in G-EQUAS

G-EQUAS reference laboratory

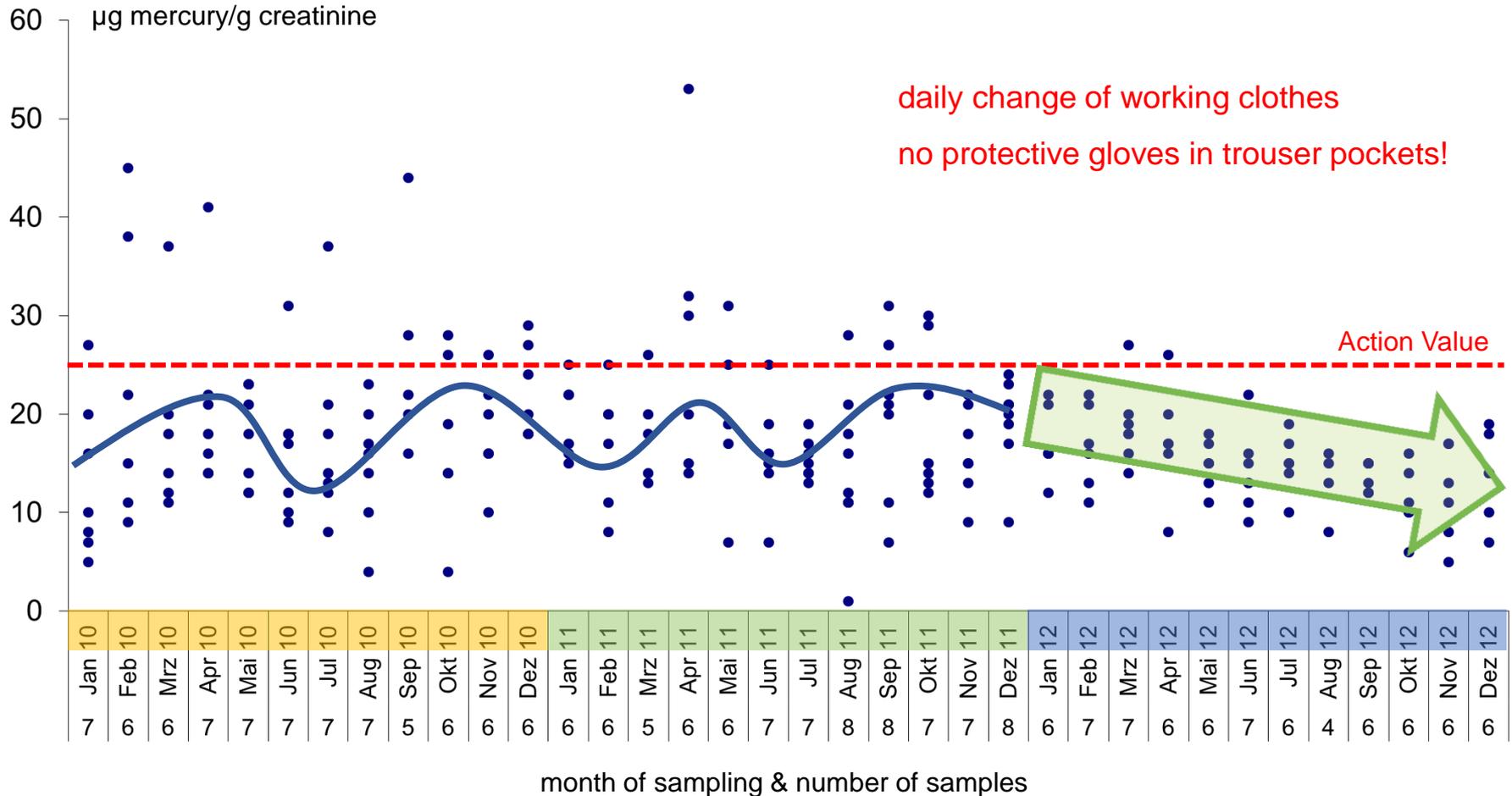
- local, regional & global services
- 73 organics, 9 inorganics (metals)
- German External Quality Assessment Scheme



Mercury exposure among chloralkali electrolysis workers

Bader M, Brill S, Schlieter A, Uebler C, Guth J (2013)

International Symposium on Biological Monitoring (ISBM), Manchester



HBM Assessment Values (@BASF)

Occupational Toxicology/Medicine

SCOEL

German Committee on Hazardous Substances

German MAK Commission

UK Health & Safety Executive

French ANSES

Finnish FIOH

US OSHA

US ACGIH

...

health-based limit values

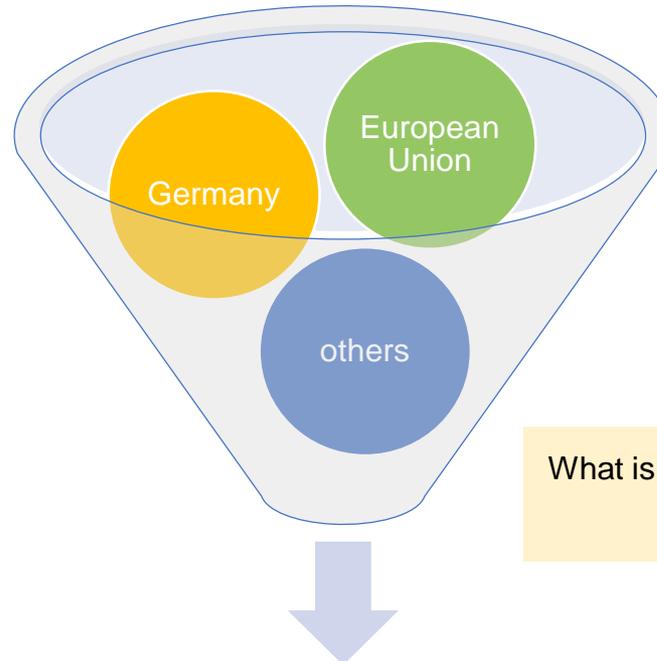
risk-based limit values

benchmark values

guidance values

background values

...



What is the magnitude of environmental and life-style related exposure?

HBM Action Values

Perspectives on environmental exposure

The exposure gap is narrowing

HBM assessment values for mercury in urine

category		remarks	value	unit
DFG	BAT	1982	200	µg/L
DFG	BAT	1998	100	µg/L
DFG	BAT	2005	30	µg/L
SCOEL	BLV	2007	30	µg/g crea.
DFG	BAT	2007	25	µg/g crea.
	BGW	2012	25	µg/g crea.
ACGIH	BEI	2013	20	µg/g crea.

category	remarks	value	unit
HBM-II value	intervention level	20	µg/g crea.
HBM-I value	observation level	5	µg/g crea.
reference value (P95)	w/o dental amalgam	1	µg/L

exposure ↘
analytical sensitivity ↗



environmental
and life-style
related exposure

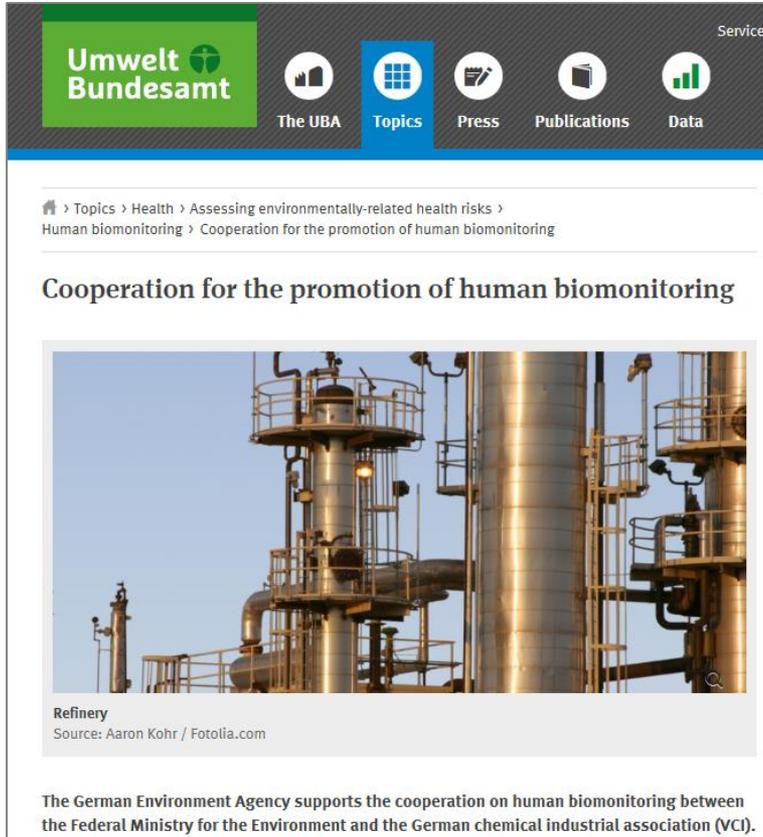
Perspectives on environmental exposure

Demand for sensitive and specific biomarkers

	Benzene	Benzene	N-Methyl-2-pyrrolidone
biomarker	ttMA-(U) (µg/g crea.)	SPMA-(U) (µg/g crea.)	5-HNMP-(U) (mg/g crea.)
action value	500	25	75
nonsmokers	150	0.5	< 1
smokers	2 - 3 times above nonsmokers	2 - 5 times above nonsmokers	< 1
diagnostic sensitivity	poor	good	very good

Perspectives on environmental exposure

Substances of emerging (public) concern



The screenshot shows the website of the German Environment Agency (Umwelt Bundesamt). The navigation bar includes 'Umwelt Bundesamt', 'The UBA', 'Topics', 'Press', 'Publications', and 'Data'. The main content area features a breadcrumb trail: 'Home > Topics > Health > Assessing environmentally-related health risks > Human biomonitoring > Cooperation for the promotion of human biomonitoring'. The title of the page is 'Cooperation for the promotion of human biomonitoring'. Below the title is a photograph of an industrial refinery with tall distillation columns and complex piping. The caption reads: 'Refinery Source: Aaron Kohr / Fotolia.com'. At the bottom of the page, a text block states: 'The German Environment Agency supports the cooperation on human biomonitoring between the Federal Ministry for the Environment and the German chemical industrial association (VCI).'

source: <https://www.umweltbundesamt.de/en/topics/health/assessing-environmentally-related-health-risks/human-biomonitoring/cooperation-for-the-promotion-of-human> (30/11/2016)



Project Partners

- Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)
- **Chemical Industry Association (VCI)**
- Federal Environment Agency (UBA)
- Federal Institute for Risk Assessment (BfR)

- consensual selection of substances of interest
- **method development & validation**
SOP, cross-validation, publication
- toxicological assessment (HBM Commission@UBA)
- population studies & surveys ⇒ risk assessment

stage	Industry
1.0	mechanization
2.0	mass production
3.0	digitalization
4.0	networked (production) systems

Paracelsus (1538) „The dose makes the poison.“

McKay et al. (2003) „The dose, not the detection, makes the poison.“

McKay CA, Holland MG, Nelson LS: Int J Med Toxicol 6 (2003) 1
American College of Medical Toxicology, Illinois

Does the chemical industry endorse Human Biomonitoring?

a strong **Yes!**

- HBM is an essential part of health protection in the chemical industry.
- For decades, HBM was driven forwards to meet the demands of occupational health protection, including low-exposure situations.
- HBM is a versatile tool for quantitative exposure analysis, efficiency control of safety measures, risk assessment and risk communication.



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