

For our environment

Umwelt
Bundesamt 

Biomonitoring – human and environmental perspectives

Use of data from targeted and random population surveys

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Section Toxicology, Health Related Environmental Monitoring

The German Human Biomonitoring System



Bundesministerium
für Umwelt, Naturschutz
und nukleare Sicherheit

**Cooperation for the
promotion of human
biomonitoring**

- *New HBM methods for
chemicals of concern*

Umwelt
Bundesamt

**Human-Biomonitoring-
Commission of UBA**

- *toxicological
assessment*
- *Health based guidance
values*

**Exposure
quantifiable?**

**Differences
within
population?
(vulnerable
groups,
sources etc.)**

**Exposure
health-
relevant?**

**Reduction
measures
sufficient or
needed?**



**German Environmental
Survey (GerES)**

- *HBM population
representative*
- *Ambient monitoring*
- *Interviews*



**German Environmental
Specimen Bank (ESB)**

- *retrospective monitoring*
- *time trends (background
exposure)*

Study design of GerES V

GerES is a **population-representative cross-sectional study** on environmental stressors

2,505 children and adolescents from **167 locations** in Germany

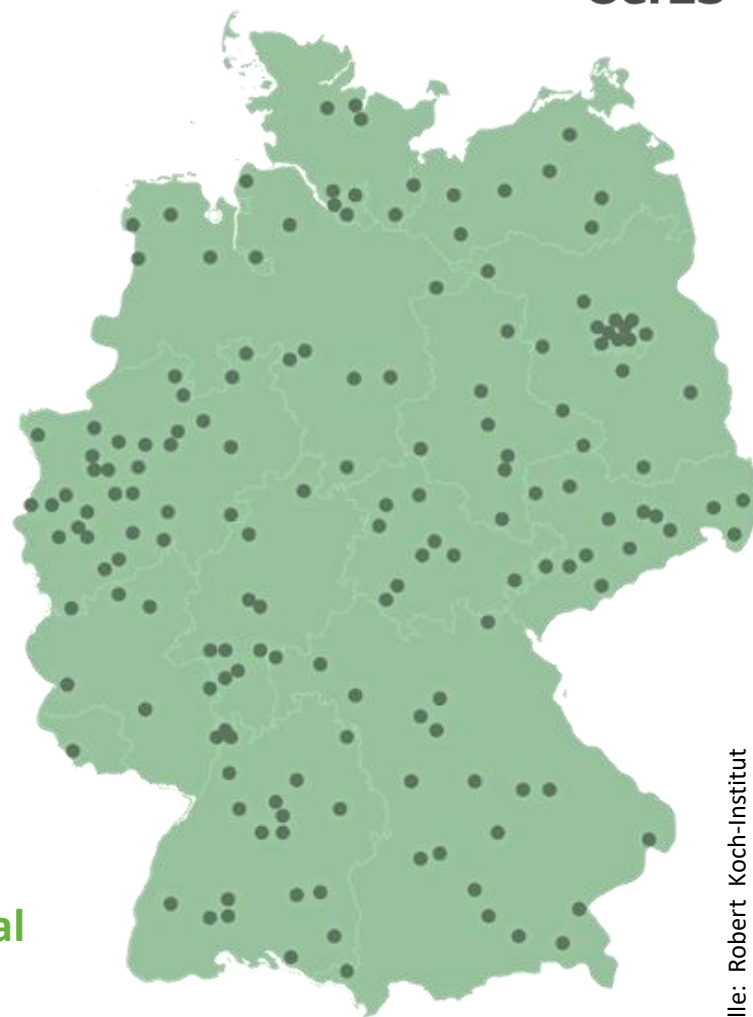
Age range: **3 to 17 years**

Subsample of KiGGS

(German Health Interview and Examination Survey for Children and Adolescents), conducted by the Robert Koch Institute (RKI).

- various **health data for all GerES participants**
- Analysis of **associations between environmental exposures and health outcomes**

Repeatedly conducted since 1995



Quelle: Robert Koch-Institut

Design of the German ESB



Started in 1977 (Münster)

Since 1997:
yearly standardized sampling at **4 locations**
approx. 120 healthy male and female
adults (20 - 29 yrs.)

No specific exposure

- **Urine** (24 hrs.)
- **Blood** (whole blood, serum)

Self-administered questionnaire

Dental anamnesis

Cryo-archiving of samples: retrospective analyses

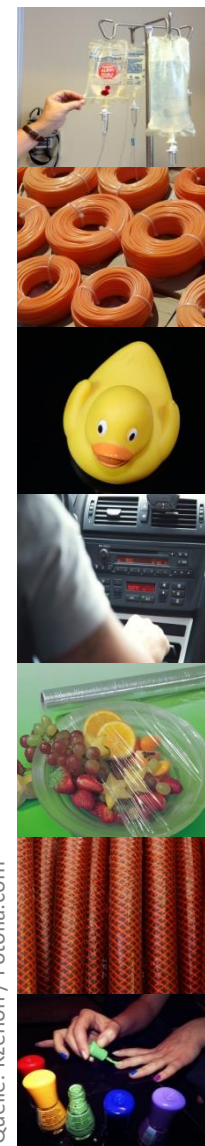


Introduction – plastics additives

Use in a large number of consumer products with **close contact to the general population** and, therefore, dermal, inhalative und oral uptake of plastic ingredients.

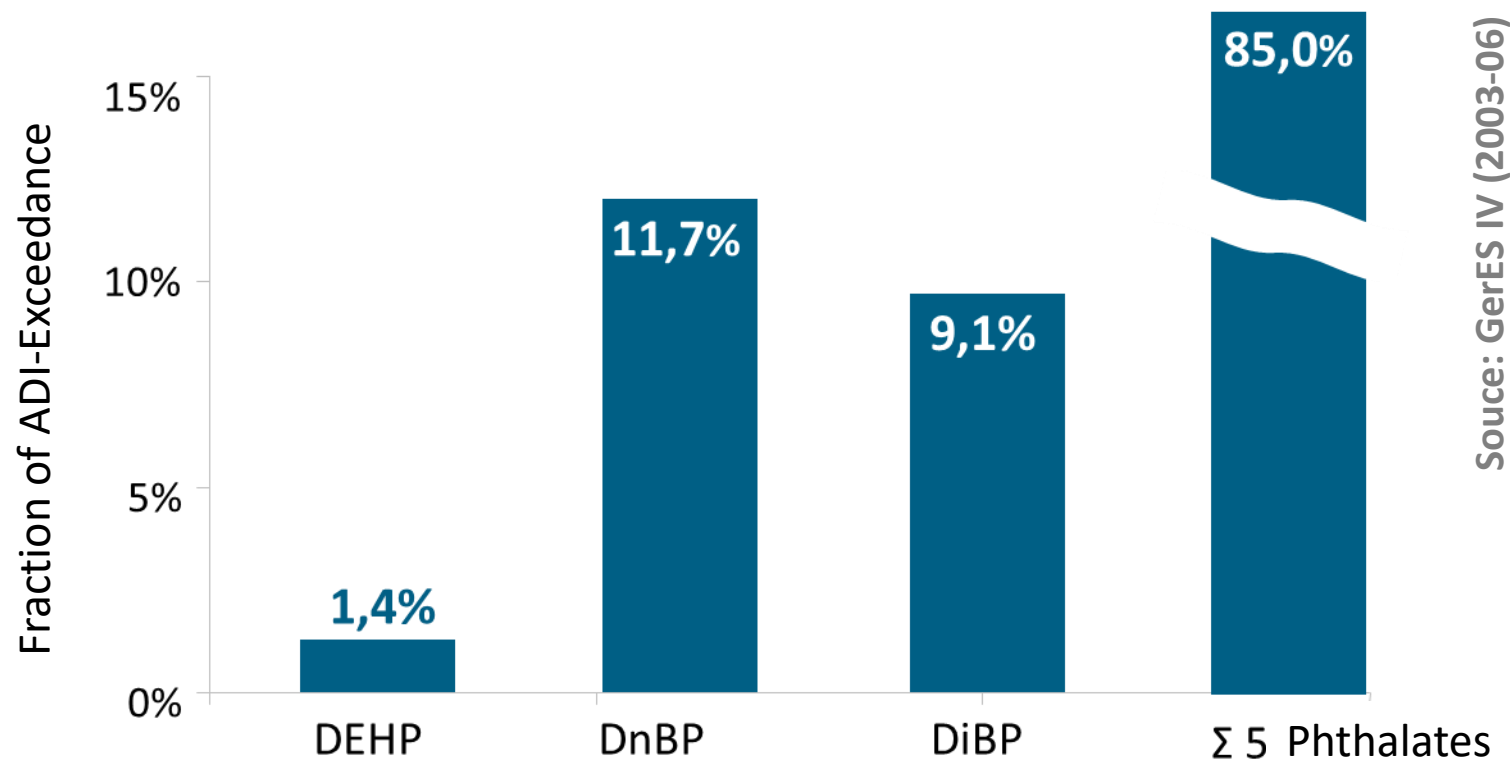
Chemically different compounds with **various toxic effects** (e. g. on reproduction, metabolism, organs, endocrine disruption).

Existing market, where well **regulated substances are** replaced by less well-investigated **new substances**.



Quelle: Kzenon / Fotolia.com

Reprotoxic: Phthalate plasticisers (C4-C6)

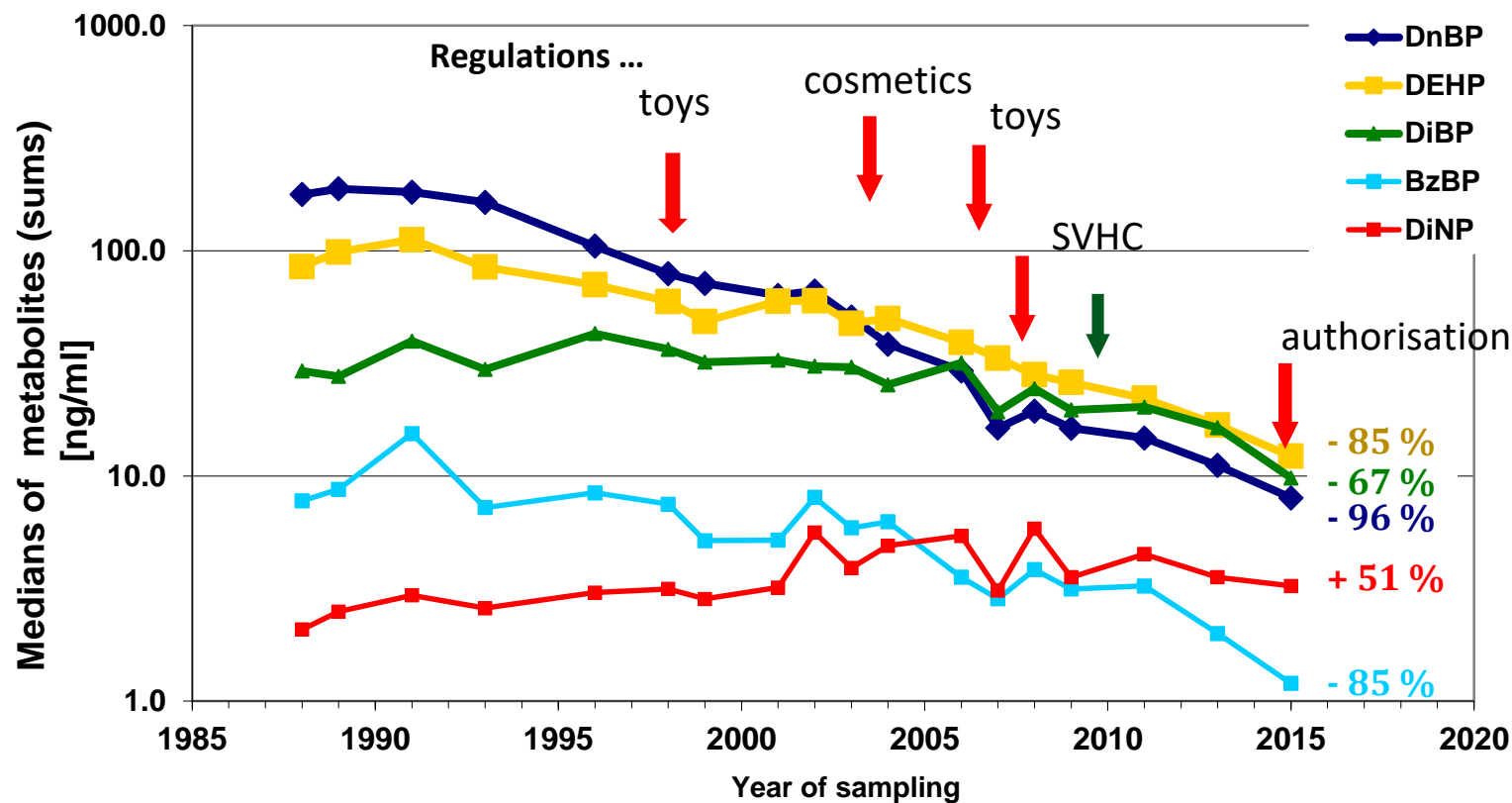


Source: GerES IV (2003-06)

Exceedance of daily intake:

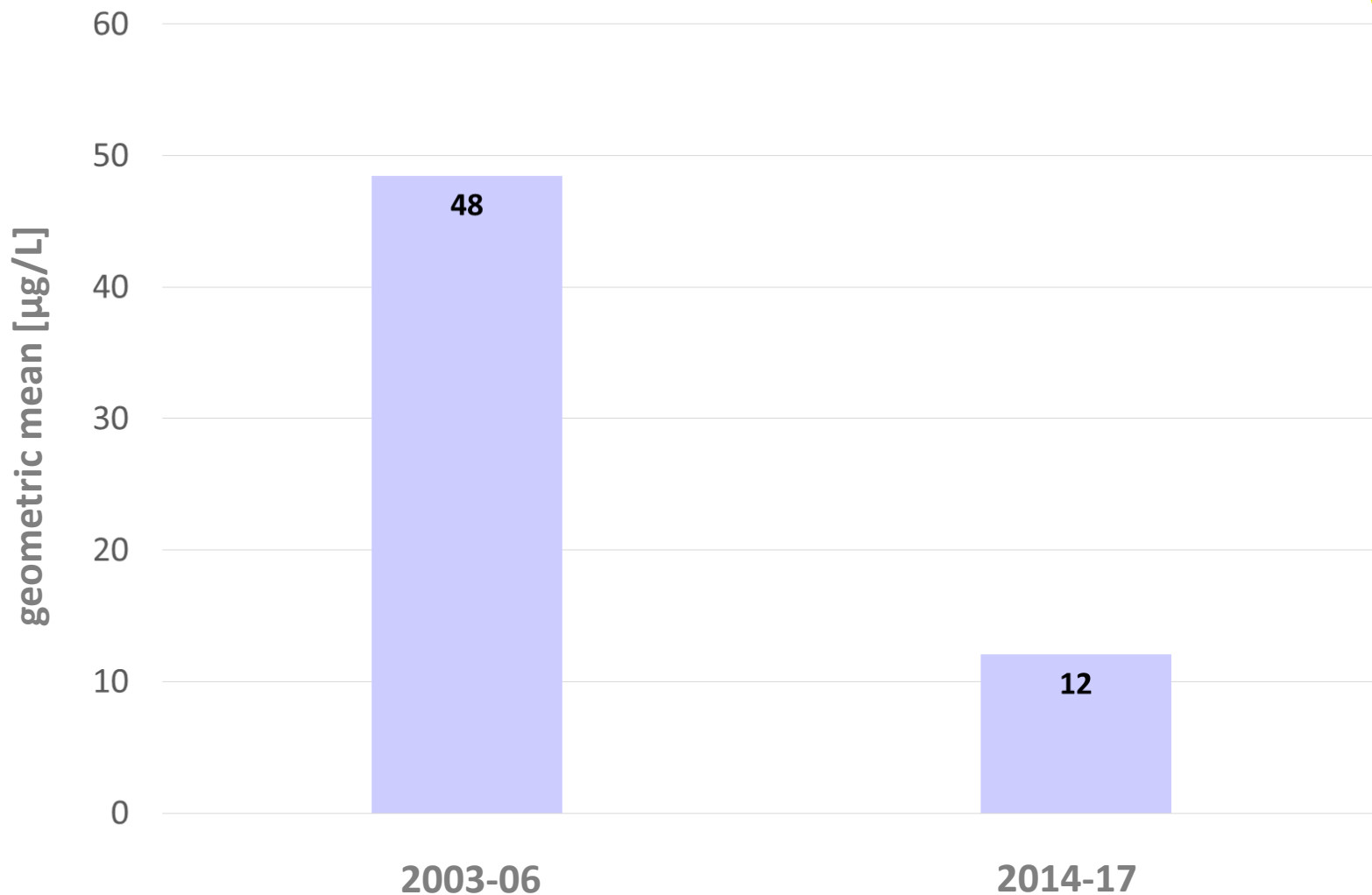
TDI:	DEHP	(Diethylhexylphthalat)	50 µg/(kg _{BW} ·d)
	DnBP	(Di-n-butylphthalat)	10 µg/(kg _{BW} ·d)
	DiBP	(Di-i-butylphthalat)	10 µg/(kg _{BW} ·d)

ESB Time Trends Phthalates 1988 to 2015



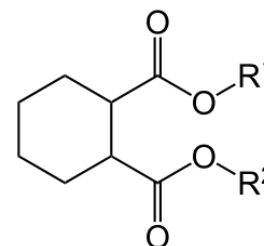
Exposure to 4 SVHC has **decreased by 67- 96 %**, still detected in every sample
 DINP **increased by 51 %**

OH-MEHP [DEHP] in urine (children 3 to 14 years)



Substitute - Hexamoll® DINCH

1,2-Cyclohexane dicarboxylic acid diisononyl ester



Substitute for phthalates with higher molecular weight (e.g. DEHP, DiNP)

Use in medical products, toys, special children items,
food, contact materials

authorised in food contact materials, toys ...

Production	per year	2002	25 000 t
		2007	100 000 t
		2014	200 000 t

TDI: 1 mg/kg KG/d (EFSA)

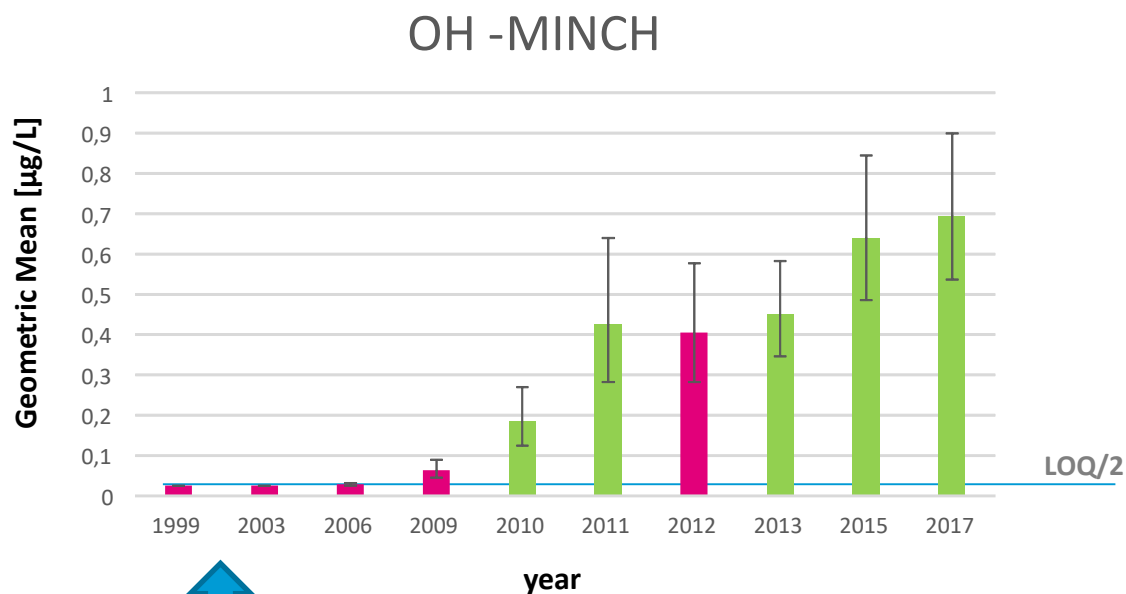
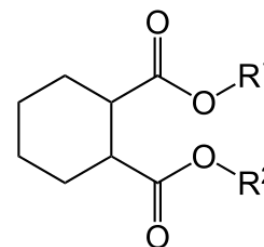
HBM-I-Value:

Sum of metabolites OH-MINCH, cx MINCH und oxo-MINCH:

3.0 mg/L children (urine)

4.5 mg/L adults (urine)

Hexamoll®DINCH (ESB)



market launch

GerES V: OH-MINCH [DINCH] - Children/Adolescent (3-17 yr.)



In GerES V DINCH was found in every sample analysed.
The younger the children the higher was the exposure.

0.4 % of children and adolescents exceed the **HBM-I-Value** for DINCH

DPHP Di(2-propylheptyl)phthalate – time trend (ESB)

Substitute for phthalates like DEHP,
NOT authorised as food contact material

Consumption per year

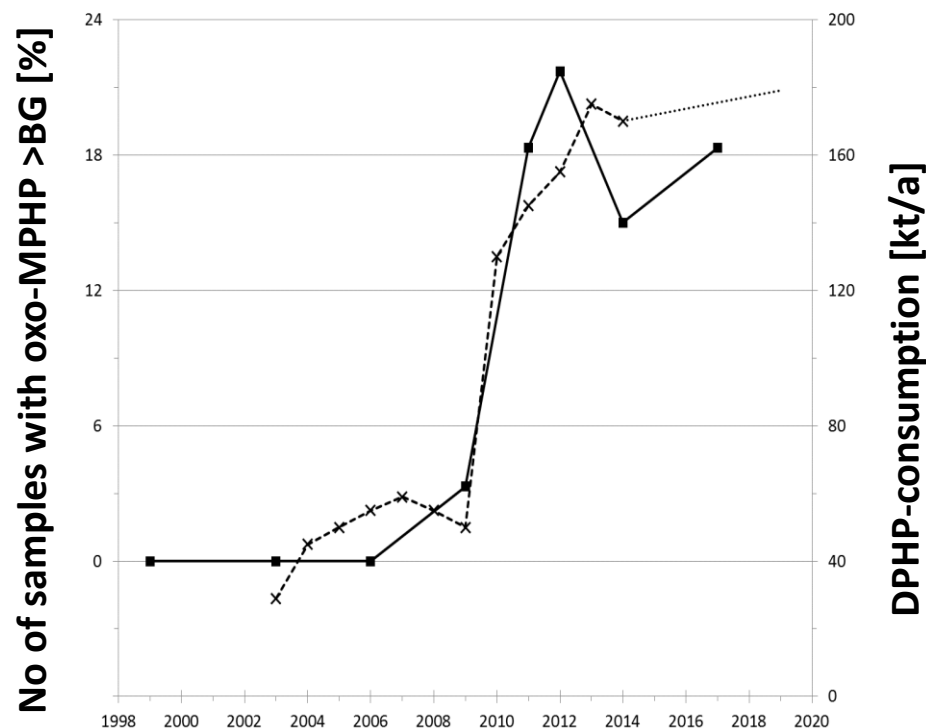
2003	29 000 t
2014	170 000 t
2019	~179 000 t

HBM-I-Value:

Sum of metabolites oxo-MPHP and
OH-MPHP

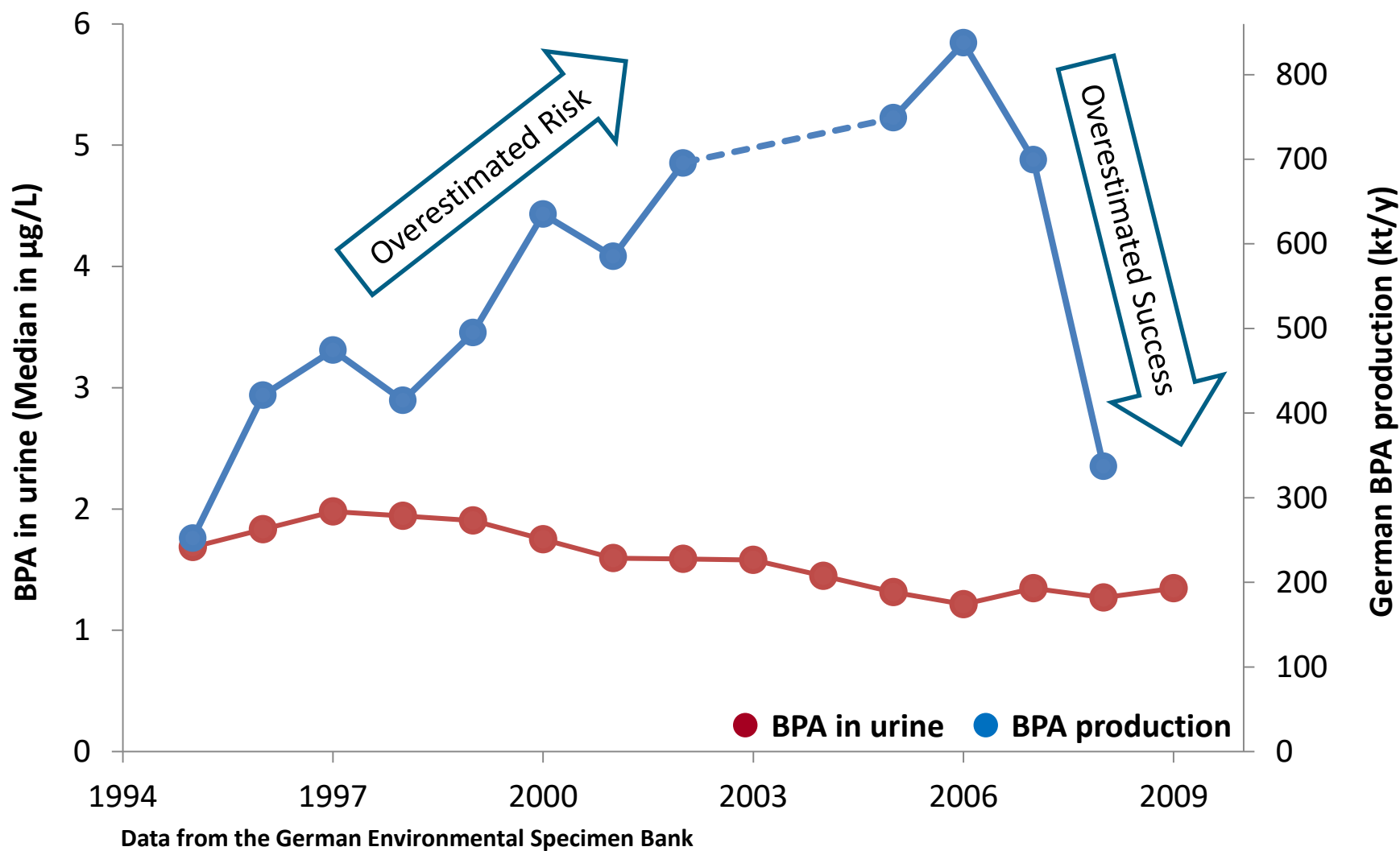
1,0 mg/L *children* (urine)

1,5 mg/L *adults* (urine)



The DPHP exposure increases with the amount consumed

Bisphenol A- time trend (ESB)



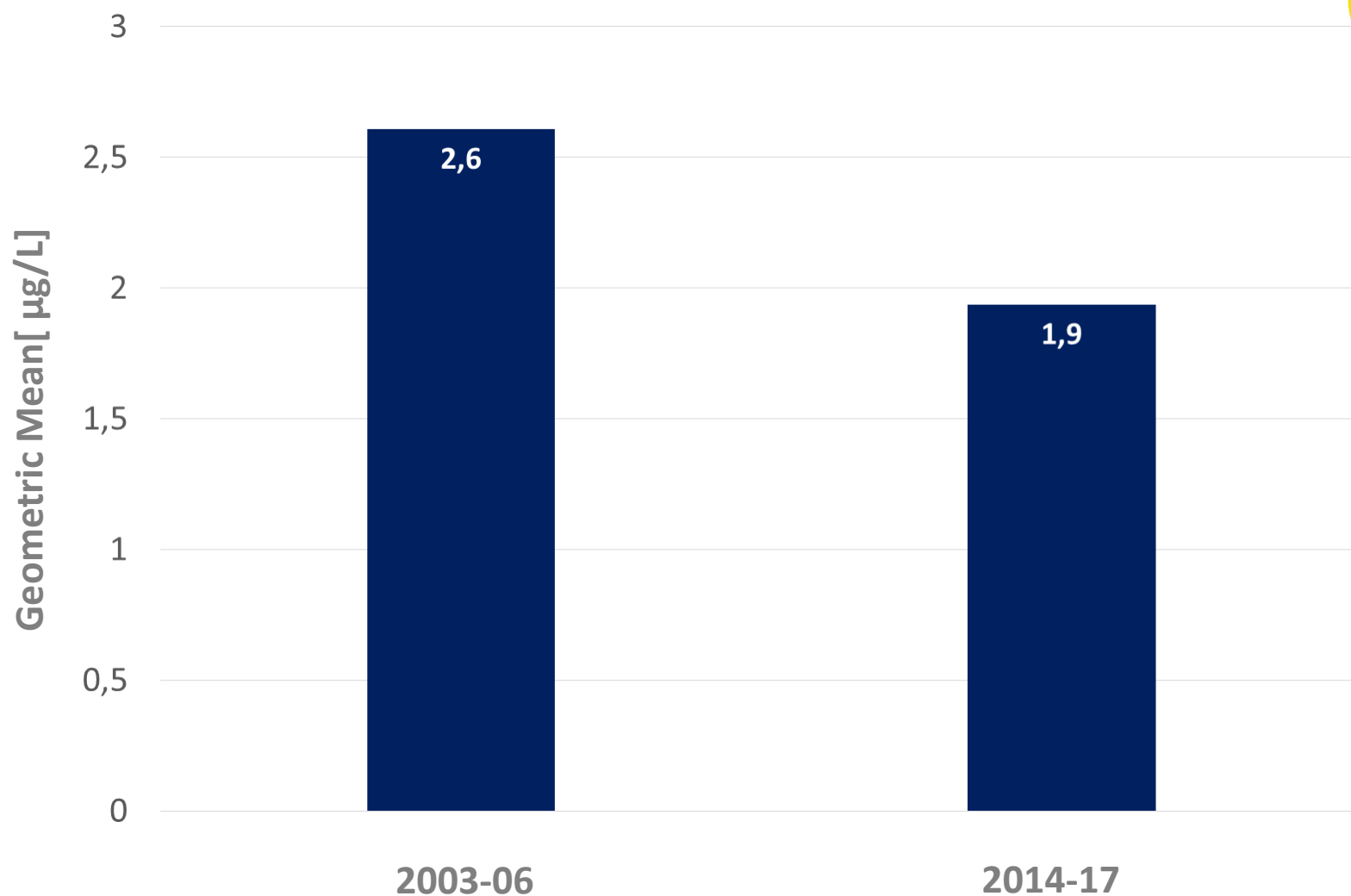
GerES V: BPA in urine – Children & Adolescent (3-17 years)



In GerES V BPA was found in 96% of the samples analysed.
The younger the children the higher was the exposure.

0,19 % of children and adolescent exceed the **HBM-I-Value**

BPA in urine (Children 3-14 years)



Conclusions – plastic additives

The exposure to „old“ phthalate plasticiser and „new“ substitute plasticiser is associated to **production and/or consumption**, this not true for other plastic ingredients like Bisphenol A.

Children are **significantly higher exposed** to plasticisers than adults **and** they are more **susceptible** to their effects.

The exposure to phthalates subjected to authorization has decreased – however, they are still **present in all samples analyzed in GerES and ESB**

Substitutes are **not as well investigated** for their toxicological properties as substituted substances

Additive effects demand evaluation of mixture toxicity

Reconsider use of plastics close to human?



Per-/polyfluorinated compounds (PFAS)

Use in many consumer products: **global dissamination**

PFAS are not readily degradable and persistent in the environment:
Accumulation in human and environment.

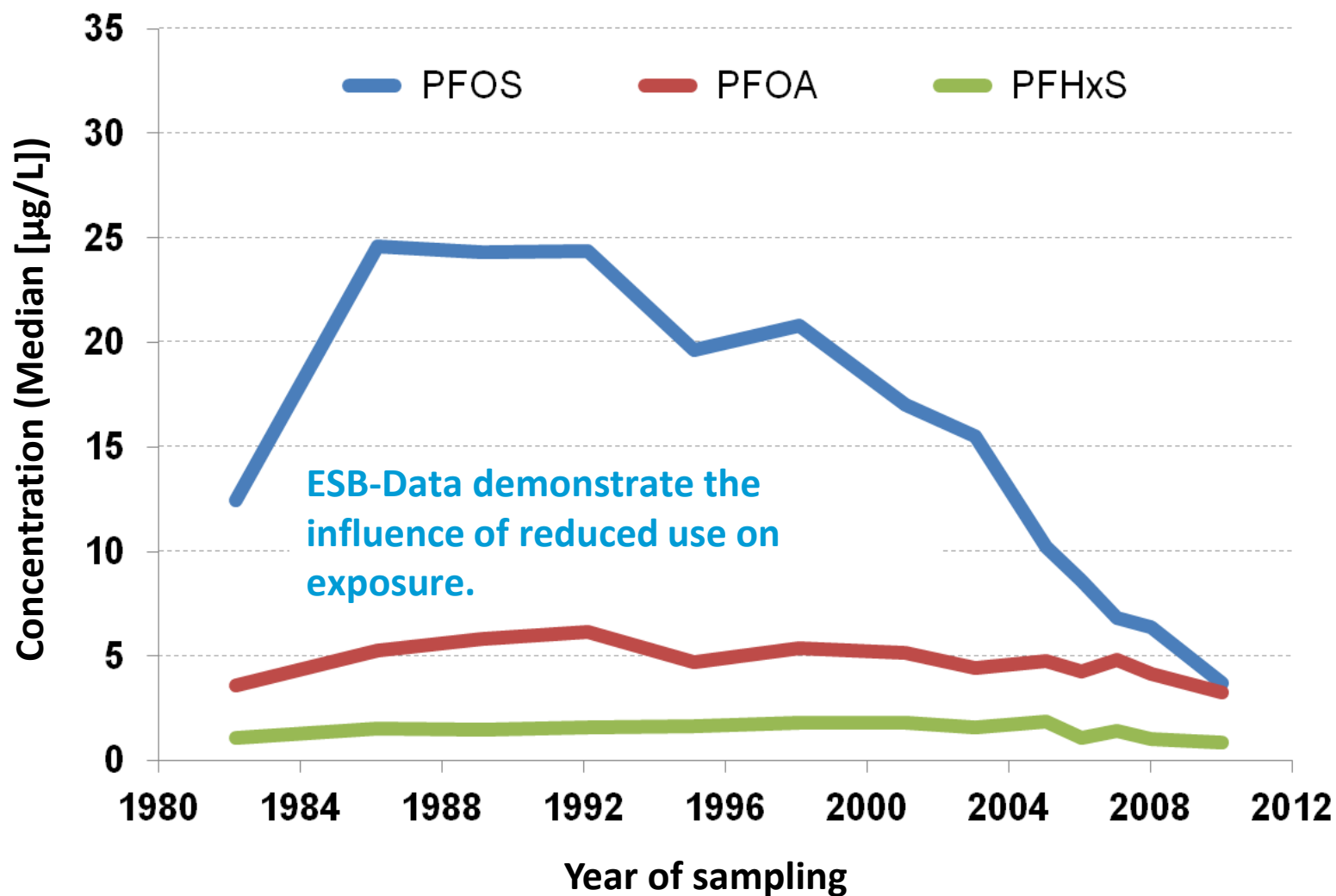
For many PFAS various **adverse health effects** are known from
epidemiological studies and animal experiments.

In some regions of Germany, **drinking water** is heavily contaminated by PFAS.

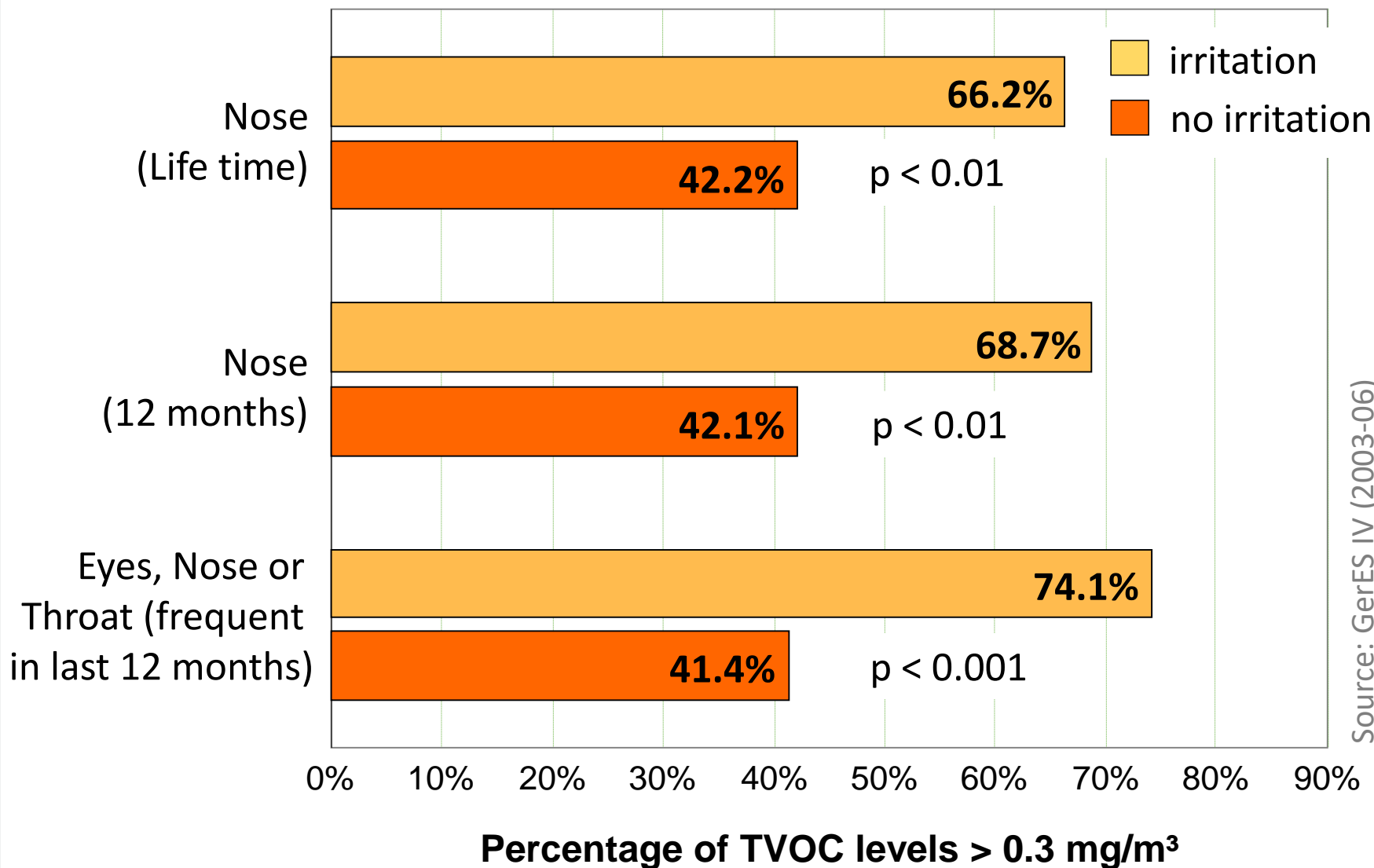


Quelle: Kzenon / Fotolia.com

PFAS – German Environmental Specimen Bank (ESB)



Prevalences and Indoor air Total VOC Levels > 0.3 mg/m³



Innovative Elements

Research programme **towards chemicals policy reform**

Direct access to the results via web site
& **to data** via IPChem



Using **data** and **samples** of relevant
European studies



Integrating political decision-makers right from the beginning

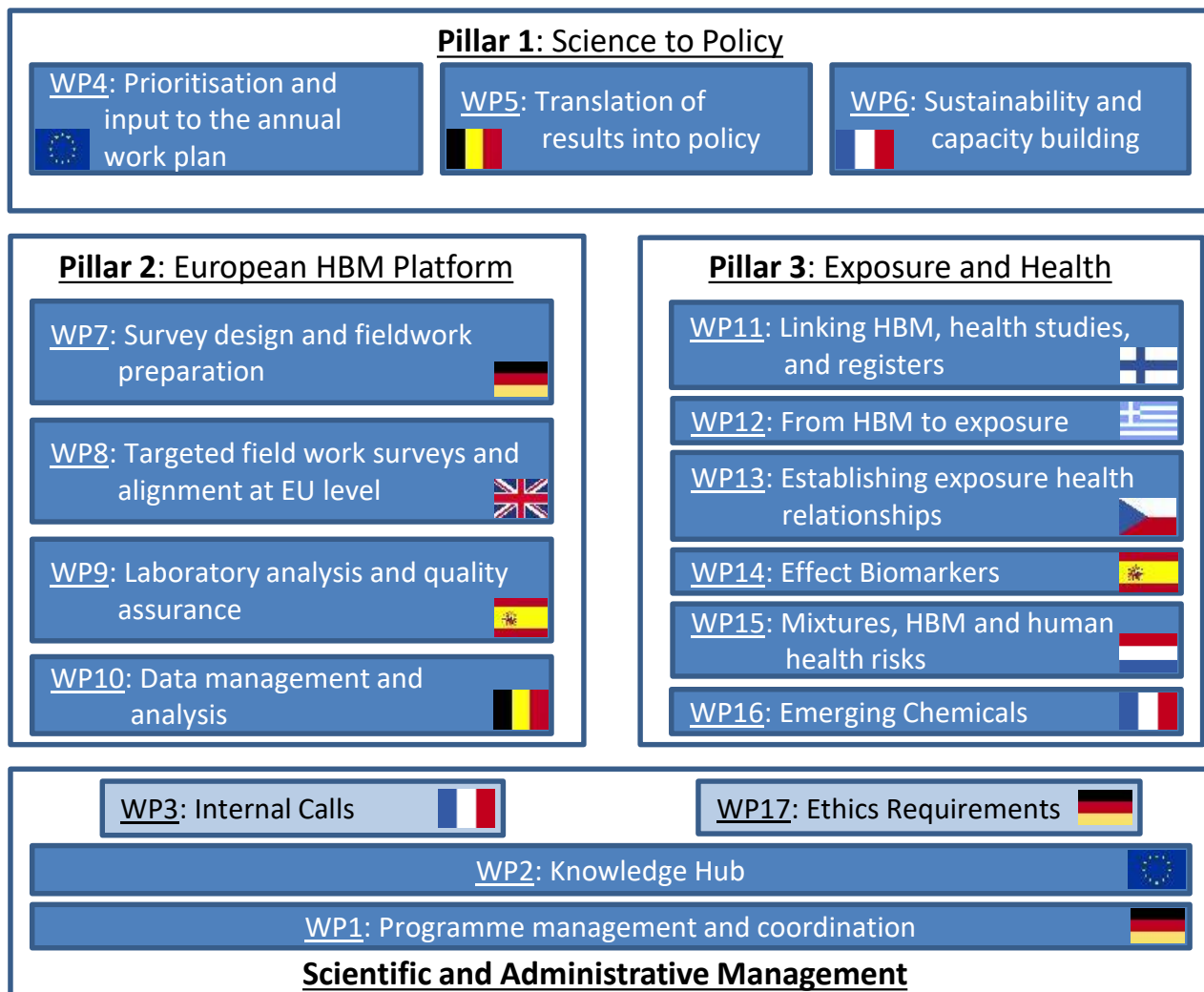
Networking of national ministries in the **Governing Board**

Exchange of different European experiences

Establishing and strengthening national networks



General structure of the HBM4EU programme



National and EU Stakeholders; Advisory Board

With HBM, policy makers show that they

- take the **concerns of people** impacted by environmental pollutants **seriously**
- take care of environmental disease burdens of the population
- strive for **data based decisions** and safeguard **fact based communication**
- use up-to-date information and **advice** from **experts independent of industry**
- care about the particular exposure situation of **socio-economically disadvantaged groups**
- create an comprehensive data set to identify and **objectively evaluate unusually high exposures** in case of regional environmental problems, and **save costs (cost-intensive comparative measurements** of unexposed persons not necessary)
- stimulate **harmonization and co-operation** in Europe and worldwide

Many thanks to the wonderful UBA- HBM team

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**Umwelt
Bundesamt** 

Thank you for your attention!

Marika Kolossa-Gehring

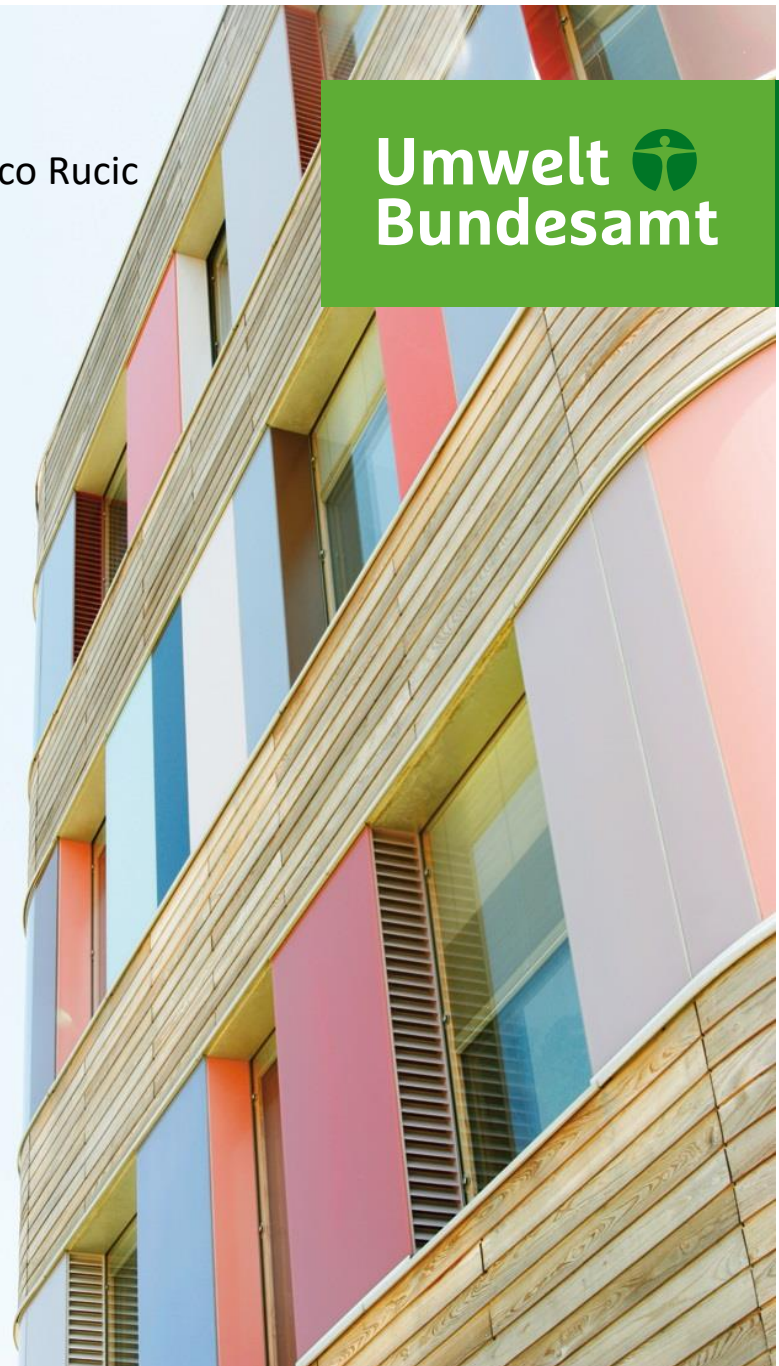
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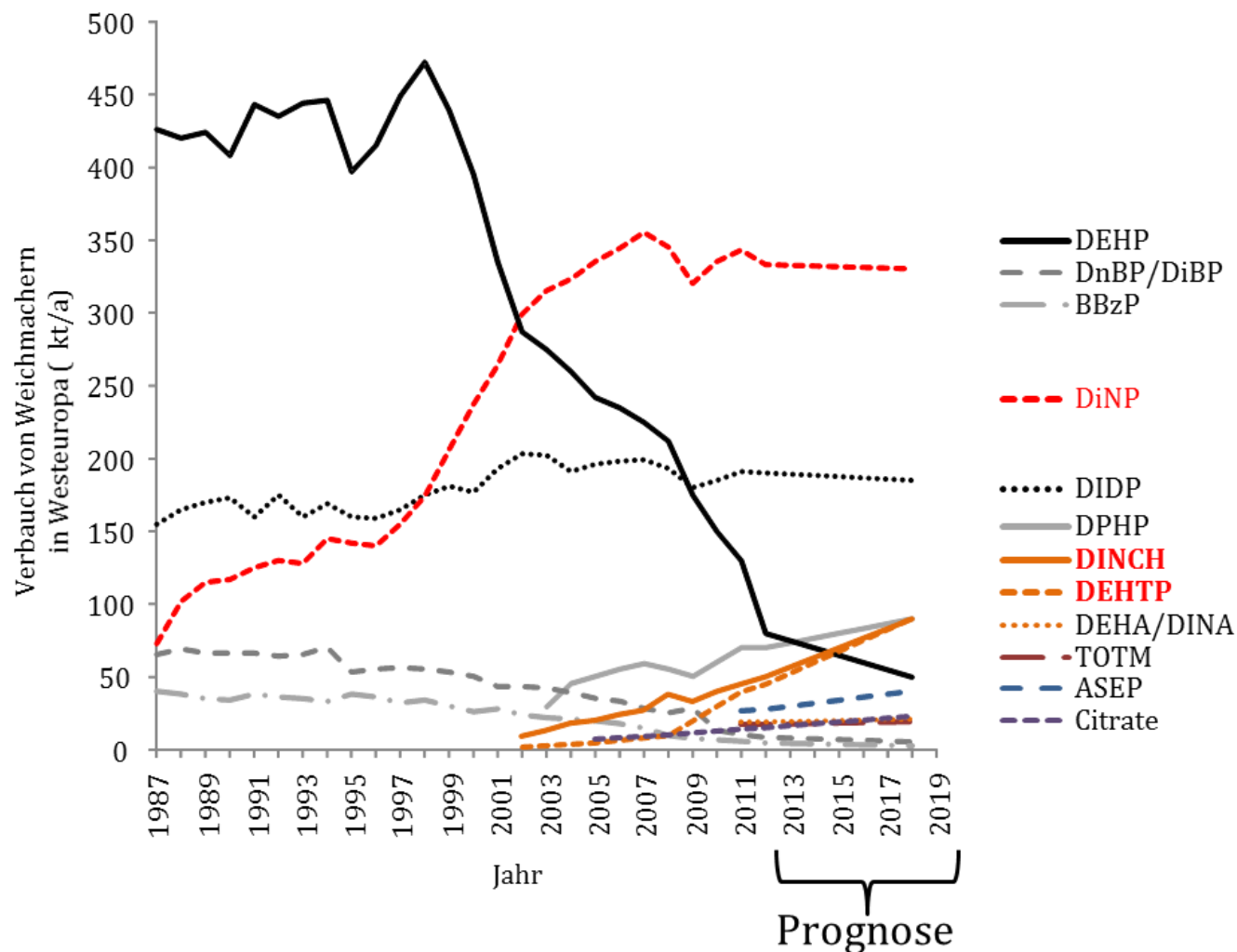
www.umweltprobenbank.de

(available also in English)

www.hbm4eu.eu



Phthalates und plasticisers substitutes



Consumption data were taken from: Bizzari et al. (2013) Plasticizers – IHS Chemical Economics Handbook