

For our Environment

Umwelt   
Bundesamt

International Conference on Risk Assessment of Indoor Air Chemicals

# How to consider children by risk assessment of indoor air chemicals?

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How to consider children by risk assessment of indoor air chemicals?

## Overview

**Children's health: The German Environmental Survey (GerES)**

**Chemical exposure of children and adults**

**Monitoring of indoor air relevant compounds**

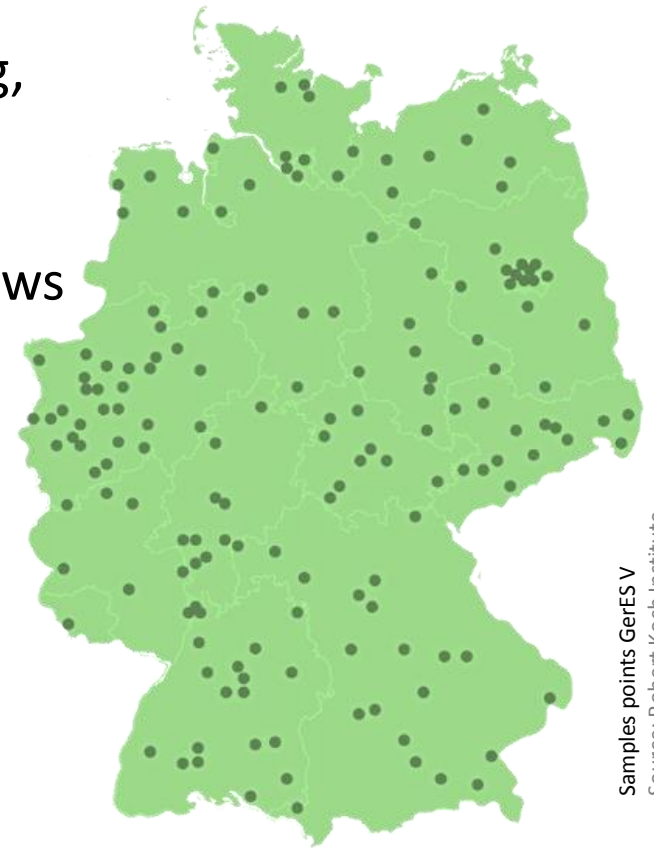
**Conclusions and Outlook**



## The German Environmental Survey (GerES)

- Population-representative cross-sectional study
- Investigating exposure and exposure sources
- Human Biomonitoring, Indoor Air monitoring, dust monitoring, drinking water...
- Comprehensive questionnaire based interviews

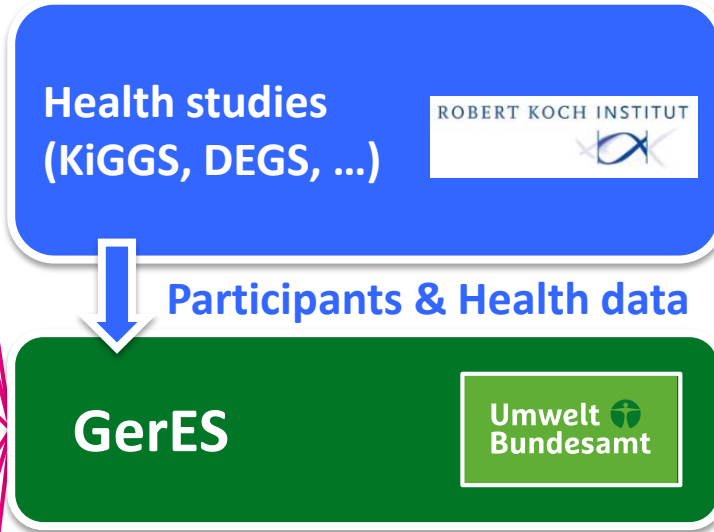
→ Representative exposure data for Germany



# Organizational structure of GerES

## Contracted GerES partners

- Field work
- Archiving & logistics
- Chemical analysis
- Software
- ...
- External QA/QC



 Federal Ministry of Health

 Federal Ministry of Education and Research

 Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

# GerES – looking back on a long tradition

GerES	Years	Number of participants	Age range
For the last twenty years GerES focussed on children and adolescents			
IV	2003 - 2006	1.790	3 - 14 yrs.
V	2014 - 2017	2.259	3 - 17 yrs.



Source: mickey hoo / Fotolia.com



Source: Christian Schwier / Fotolia.com



Source: .shock / Fotolia.com



Source: Monkey Business / Fotolia.com

# Chemical body burden vs. environmental exposure

## Human biomonitoring (HBM)

Blood, blood plasma, urine

Global first-time application of new HBM methods in a population study established by the cooperation between the German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB) and the German Chemical Industry Association (VCI)

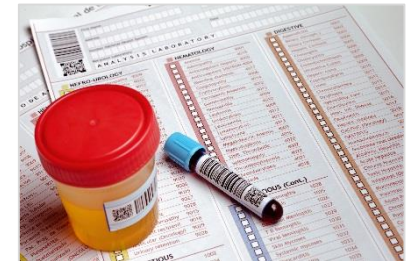
## Indoor environment monitoring

Indoor air

(passive sampling tubes, weekly average, TVOC 58 compounds)

House dust

PM<sub>2,5</sub>



Source: angellodeco / Fotolia.com



Source: mitev / Fotolia.com



Source: auris / Fotolia.com

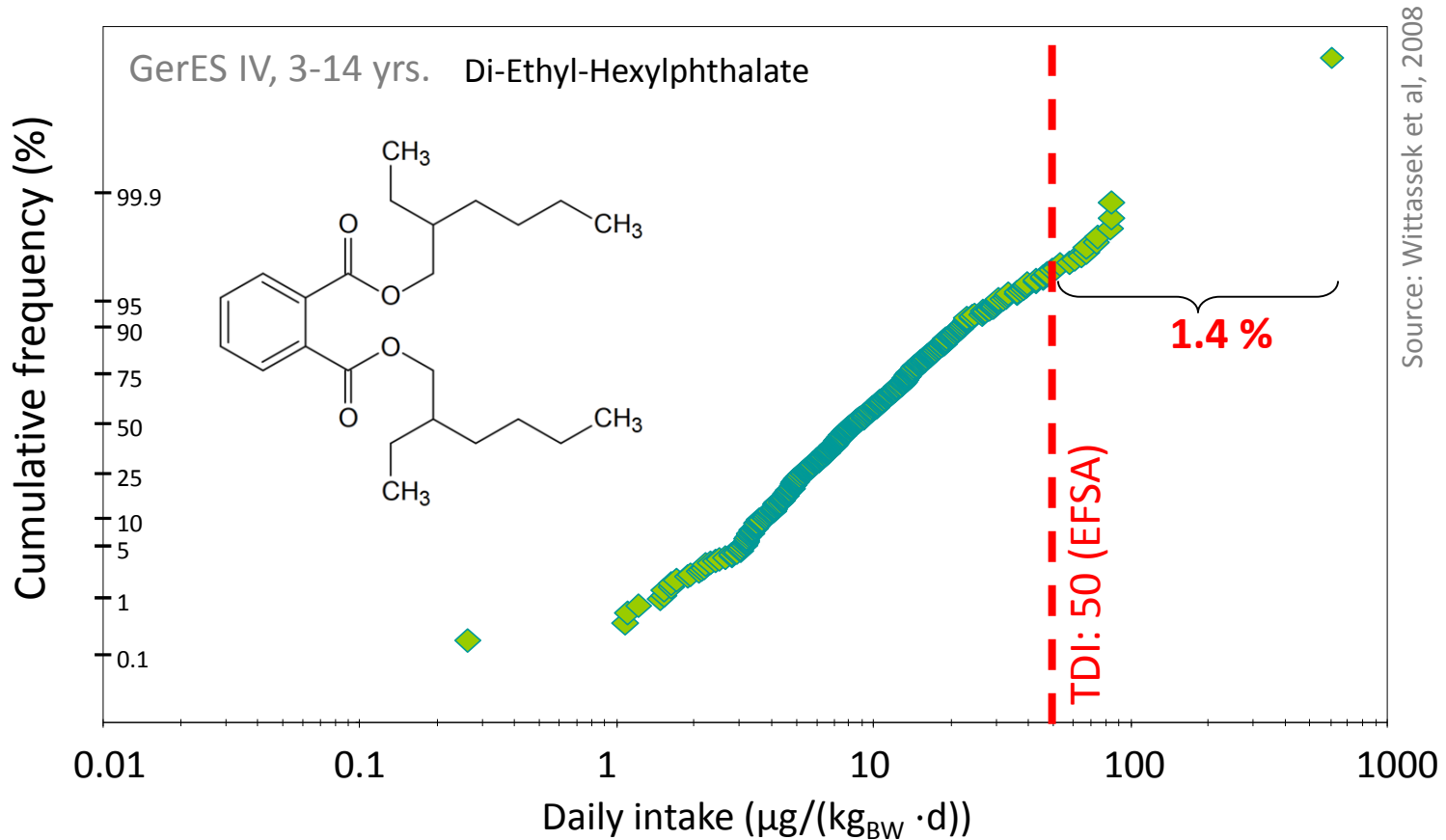
## Drinking water monitoring

## Interviews and questionnaires



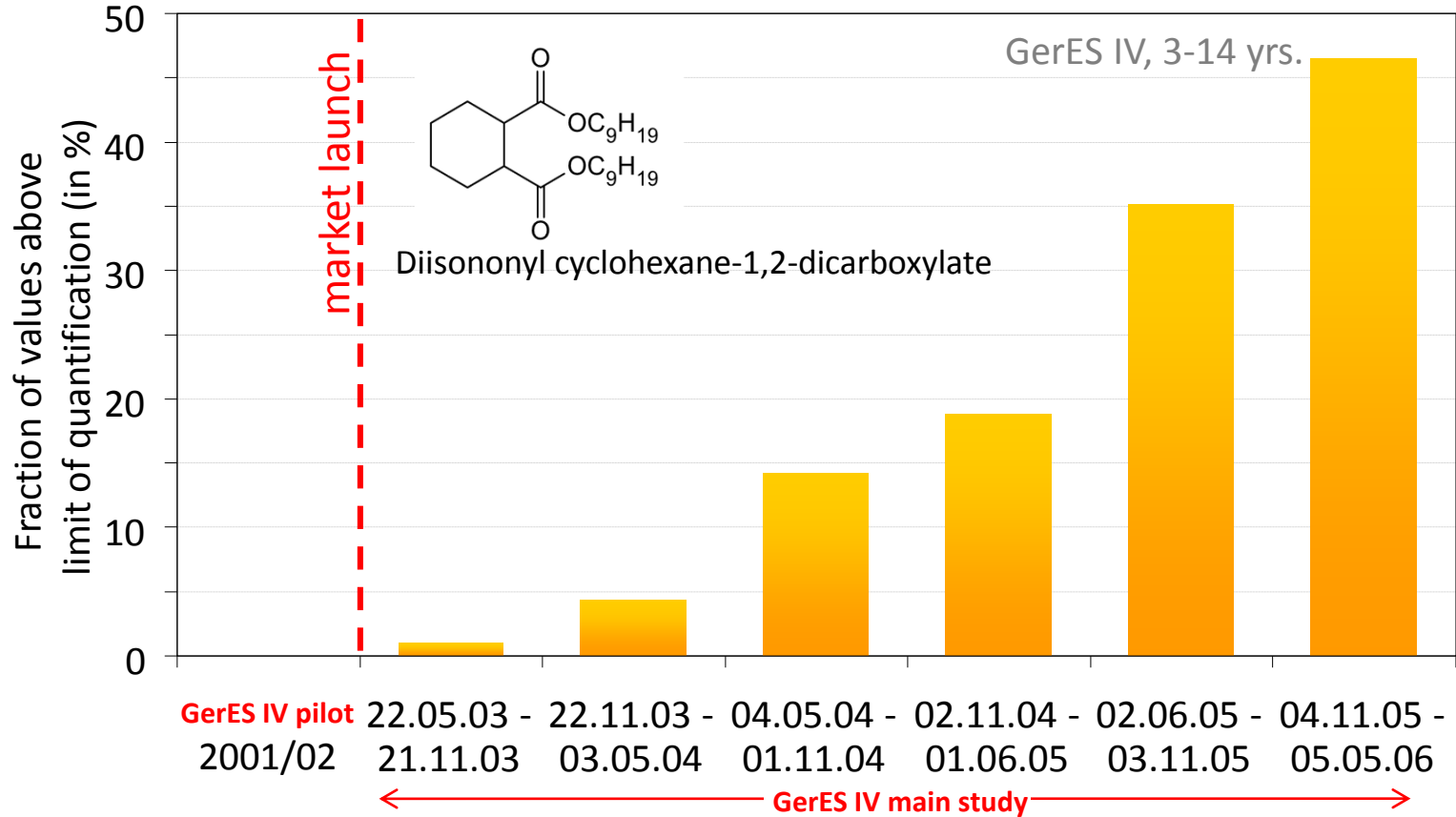
Source: Constanze Fruth

# HBM for policy-makers: children's exposure to DEHP



Important contribution for the discussion on regulating DEHP under REACH.  
TDI exceedance basis for derivation of health-based HBM assessment value (HBM-I).

## Indoor environment data for policy-makers: DINCH in house dust

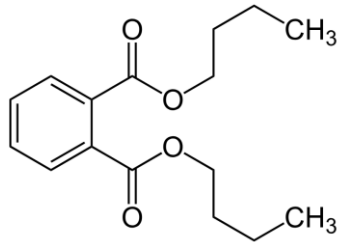


➡ increasing appearance of DINCH in indoor environments

Nagorka, Conrad et al. (2011)

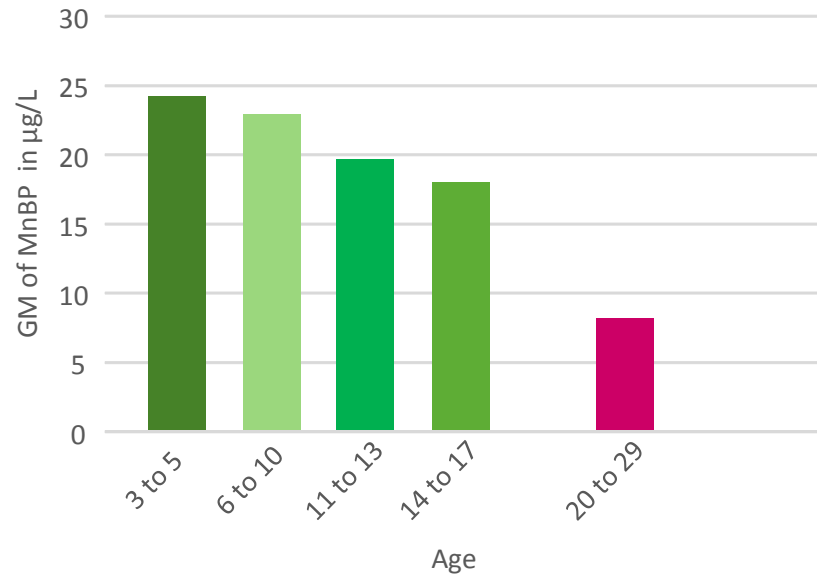


# Exposure differences between children and adults



Di-n-butylphthalate (DnBP)

CLP Repr. 1B



Extreme difference in exposure between adults and children

Preliminary data!

## The German Committee on Indoor Guide Values

### Health assessment through guide values:

- toxicologically derived
- for individual substances (e.g. naphthalene)
- for substance groups (e.g. low-aromatic hydrocarbon mixtures (C<sub>9</sub>-C<sub>14</sub>))

### Hygienic assessment scheme for TVOC (Value for the sum of all measured VOC):

Stage 1	≤ 0.3 mg/m <sup>3</sup>	hygienically safe
Stage 2	> 0.3-1 mg/m <sup>3</sup>	hygienically safe, if no guide value is exceeded
Stage 3	> 1-3 mg/m <sup>3</sup>	hygienically conspicuous
Stage 4	> 3-10 mg/m <sup>3</sup>	hygienic cause of concern
Stage 5	> 10 mg/m <sup>3</sup>	hygienic unacceptable

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## GerES IV - indoor air: total volatile organic compounds (TVOC)

**TVOC:** Value for the sum of all measured VOC (in total 58 compounds)

**Hygienic assessment scheme\*:**

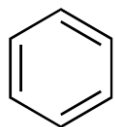
Stage 1	$\leq 0.3 \text{ mg/m}^3$	hygienically safe	<b>54.8%</b>
Stage 2	$>0.3-1 \text{ mg/m}^3$	hygienically safe	<b>37.1%</b>
Stage 3	$>1-3 \text{ mg/m}^3$	hygienically conspicuous	<b>3.4%</b>
Stage 4	$>3-10 \text{ mg/m}^3$	hygienic cause of concern	<b>0%</b>
Stage 5	$>10 \text{ mg/m}^3$	hygienic unacceptable	<b>0%</b>

Only half of the children live in desirable indoor air conditions

\*The German Committee on Indoor Guide Values

## GerES IV - indoor air: exceedence of limit/guide values

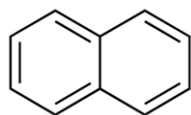
Indoor air samples of approx. 600 households



Benzene

GerES IV > LOQ= 75%      >5  $\mu\text{g}/\text{m}^3$  = 11.6%

Directive on ambient air quality and cleaner air for Europe  
for **outdoor air** (yearly average)

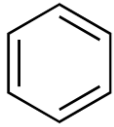


Naphthalene

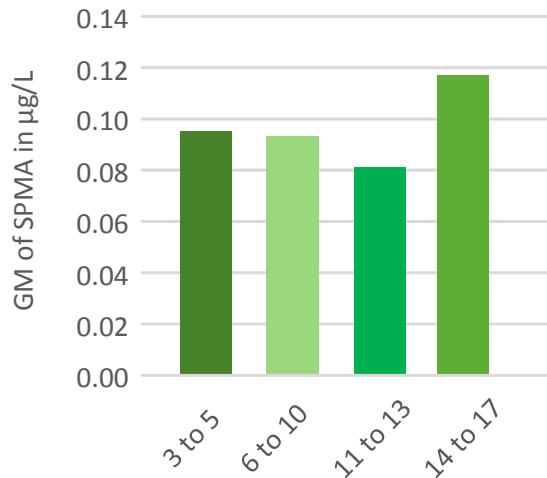
GerES IV > LOQ= 7%      >10  $\mu\text{g}/\text{m}^3$  = 0%

guide value I by the German Committee on Indoor Guide Values

# GerES V - HBM data: indoor relevant chemicals

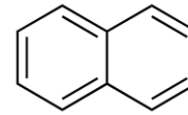


Benzene

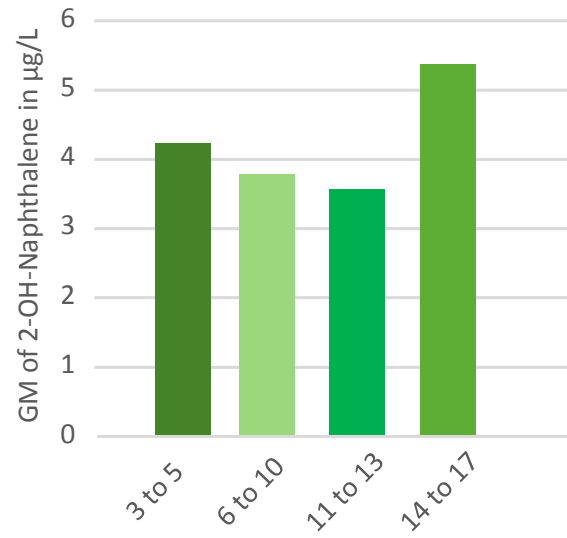


Age  
N>LOQ=98%

CLP Regulation: Carc. 1A



Naphthalene



Age  
N>LOQ=100%

Carc. 2

→ all participants are exposed to the carcinogens in relevant concentrations



Preliminary data!

## In Conclusion ...

- Multi chemical exposure in indoor air and human matrices measurable
  - **Children are a more sensitive and higher exposed group**
  - Multi chemical exposure to reprotoxic and cancerogenic substances in all children measurable
  - **Protective implementations of risk assessment necessary**
- **More data necessary to determine the impact of indoor air exposure on health effects in children**

Thank you very much  
for your attention.

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[www.uba.de/geres](http://www.uba.de/geres)

