

## **Human Biomonitoring in Europe and Germany – science and policy for a healthy future.**

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The German population is substantially exposed to various chemicals. Some of which have already been restricted or cannot be reasonably further regulated, other compounds raised concern more recently. Exposure levels and sources as well as their development over time are well documented by the German Human Biomonitoring (HBM) System consisting of the German Environmental Survey (GerES) and the German Environmental Specimen Bank (ESB).

GerES regularly generates representative cross-sectional data on the exposure of the German population, the ESB is analyzing exposure time trends in a non-specifically exposed population. GerES and ESB data are used to derive reference values for selected chemicals, analyze trends, identify sources, derive exposure reduction measures, and identify higher exposed sub-groups. Information is transferred target group-specifically to government and policy makers, the scientific community, the general population including sub-groups with special needs, and to study participants.

As one of the main national instrument, GerES has repeatedly been carried out since the mid-1980s. GerES evaluates pollutant body burdens in population-representative samples, the contribution of different media (e.g., indoor air, drinking water, and food) to the overall exposure, and links human biomonitoring (HBM) to health data. GerES is conducted in close co-operation with the National Health Interview and Examination Surveys (NHIES) performed by the Robert Koch-Institute.

GerES V (2014-2017) investigating children and adolescents aged 3 to 17 years focused on emerging substances with potential health relevance and/or assumed exposure of the general population, such as plasticizer alternatives like Hexamoll® DINCH and di-2-propylheptyl phthalate (DPHP), the solvents N-methyl- and N-ethyl-2-pyrrolidone (NMP/NEP), 6 parabens, Triclosan and the vulcanization accelerator 2-mercaptobenzothiazole (2-MBT). GerES V revealed that about 30 % of the chemicals analysed could be found in almost every participant. These included metals like lead and arsenic, eight phthalates, the alternative plasticiser Hexamoll®DINCH, chlorphenols, PAHs, PFOS, the pyrrolidone NMP; organochlorpesticides, bisphenol, acrylamide and benzene. This proof of multiple exposures underlines the urgent need for a further development of risk assessment schemes which need to include the analyses of aggregate exposure and possible additive effects.

Today, the European Union is responsible for chemical policy in the EU member states. Against this background, the European Joint Programme HBM4EU was developed to help further improving chemical regulation and, thus, protecting European citizen against the impact of environmental pollutants on health.

Key objectives of HBM4EU are:

1. Harmonizing procedures for HBM, to provide policy makers with comparable data on human internal exposure to chemicals and mixtures of chemicals in Europe
2. Linking data on internal exposure to chemicals to aggregate external exposure and identifying exposure pathways and upstream sources. Information on exposure pathways is vital for targeted policy measures aiming for exposure reduction.
3. Generating scientific evidence on the causal links between human exposure to chemicals and negative health outcomes and
4. Adapting chemical risk assessment methodologies to use HBM data and account for the contribution of multiple external exposure pathways to the total body burden of various chemicals.

HBM4EU will achieve these objectives by harmonizing national HBM initiatives, drawing on existing expertise and building new capacities. We will create a robust HBM Platform at the European level by establishing National Hubs in each country to coordinate national and European activities.

HBM4EU follows an innovative approach to generate the knowledge policy makers need to improve policy in the field of environment and health. The overarching goal of HBM4EU is to generate new knowledge, to inform safe management of chemicals, and consequently protect human health in Europe. Human Biomonitoring (HBM) data provide information on the aggregate exposure from all sources and by all pathways. They will, therefore, serve as the basis to assess the risks from human exposure to chemicals. Intensive communication with policy makers beginning already at the state of planning will ensure that HBM4EU results are used in the further development and design of new chemicals policies as well as the evaluation of existing measures.

HBM4EU currently consists of 112 partner organizations from 28 countries and is organized around 16 work packages led by key players of national HBM studies and research programs. Major fields of activities are the science policy transfer, HBM studies, and research to elucidate the impact of exposure on health. HBM reveals the extent and quality of multiple chemicals exposures. Therefore, one HBM4EU work package focuses exclusively on mixtures. These data also demonstrate the need to develop concepts for health risk assessment beyond traditional single substance evaluation methods.

HBM4EU contributes directly to the improvement of health and well-being for all age groups, by investigating how exposure to chemicals affects the health of different population sub-groups, such as, children, pregnant women, fetuses and workers. We will also investigate how factors such as behavior, lifestyle and socio-economic status may influence internal exposure to chemicals across the different European countries.

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