

Group 1 National Hub Template (HBM data for Awareness)

Group Leader: Lisbeth Knudsen ([liek@sund.ku.dk](mailto:liek@sund.ku.dk))

Name and email of National Hub Author: Ovnair Sepai UK NH

[Ovnair.sepai@ukhsa.gov.uk](mailto:Ovnair.sepai@ukhsa.gov.uk), [Dorothy.ubong@ukhsa.gov.uk](mailto:Dorothy.ubong@ukhsa.gov.uk); [Lorraine.stewart@ukhsa.gov.uk](mailto:Lorraine.stewart@ukhsa.gov.uk)

<b>Introduction:</b>	
Background information on the evolution and status of HBM in your country.	<p>HBM has been well established as a tool for occupational health assessment in the UK for many decades. HBM has been used in small targeted studies or in relation to focused geographical or hot spot environmental issues but to date there are no National or regional population representative HBM programmes. UK or England has been involved in European HBM initiatives since 2003. Starting with ESBIO, then COPHES/DEMOCOPHES and now HBM4EU. The goal is to have a structured HBM programme for the UK (England) which will support chemical management, policy development and evaluation as well as raise awareness of chemicals and public exposure to environmental pollutants. This is to enable the public to make informed decisions. In the last 10 years there have been many requests for HBM in response to incidents or to determine background exposures. Support from government departments has increased but the available funds has always been the main barrier. It is important for future development to be able to monetarise the benefits of carrying out population based HBM, not just the reduction in risk but the reduction in adverse health. The impact on the health service of ill health caused by chemical exposure or loss of earnings. This is a tough challenge. NH members discussed below.</p>
<b>Main text - Results and Discussion</b>	
<b>ENSURE YOUR NARRATIVES ARE REFERENCED AS FAR AS POSSIBLE</b>	
<ul style="list-style-type: none"> <li>• Description of issue(s) which have resulted in the raising of awareness.</li> <li>• Include brief description of sample population, substances of concern and whether local/regional/national.</li> </ul>	<p>Over the last 2 or 3 decades there have been calls for human biomonitoring to determine exposure to environmental pollutants. Some examples are given below - this is not an exhaustive list but a few which attracted the highest political interest.</p> <p>In 2001 there was a highly political issue with the use of fly ash from Incinerators as spread across allotments in the North East of England<sup>1</sup>. The ash contained high qualities of <b>dioxins, furans and heavy metals</b>. There were requests for human biomonitoring to determine the level of uptake of these contaminants. This was not carried out as it was felt this would lead to disproportionate anxiety instead the advice given was not to consume products from these allotments. Eggs, poultry, and vegetables from the allotments were declared as unsafe for human</p>

consumption. Follow-up epidemiology studies did not show an increase in body burden of dioxins in the local population<sup>ii</sup>.

In 2004, the World Wildlife Fund carried out an evaluation of environmental pollutants in the blood of Members of the EU Parliament<sup>iii</sup>. Exposure to 101 man-made chemicals in groups such as **phthalates, flame retardants and PCBs**. as This raised many questions in the media. The WWF study was criticised as it did not give any advice as to the possible health consequence and was considered as a sensational publicity stunt. In England the Department of Health asked whether the same evaluations should be carried out in a well-designed HBM study in the general population. However, as the inability to interpret such internal exposure data from a health perspective it was felt that such a study would not lead to appropriate health advice and thus have no real public health benefit. This highly publicised study did, however, raise awareness and brought the debate regarding the need for a HBM programme for England back to the table.

2021 - lead action level reduced in England. **Lead** is a public health issue that has received less interest recently due to the historical strategies to reduce exposure via removal of lead from petrol, legislation to reduce the quantities of lead in consumer products as well as regulation of drinking water. Clinical cases are still reported of children with high blood lead levels (BLLs). The cases are often due to living in older housing (lead in old paint or water pipes), those who consume alternative medicines and children with pica activity. These cases are generally associated with lower income families and ethnic minorities. BLLs, biomarker of exposure to lead, is a means to determine exposure level and potential risk. England implemented a reduced 'action level' of 5 micrograms per decilitre in 2021. This is in line with action levels used in Wales and in many other countries.

PHE deals with many incidents including fires, chemical spills, landfill site etc where populations are potentially exposure to levels of environmental pollutants which may be detrimental to health. Due to the increased public awareness of HBM there are requests for HBM studies to be carried out in response to these incidents. It is often not possible to initiate such a study for many reasons: the timeframes for sample collection would not allow appropriate exposure assessment, there is no control population, ethical approval has not been obtained, and of course funding.

In the South-West of England (Cornwall) the natural granite bedrock is a source of environmental arsenic. The area had a strong historical arsenic and tin mining industry. Interestingly, Cornwall produced around half of the world's arsenic in the 19<sup>th</sup> century. The mining process brought much of the natural arsenic to the surface and has been known to contaminate soil, surface and wells used for drinking water. There are numerous private water supplies in Cornwall which are not regulated by water companies many of these supplies (wells, standpipes etc) are contaminated with **arsenic and heavy metals**. Early in the 2010s (2011 - 2013), a study was carried out by the Health Protection Agency (HPA now part of PHE) and showed that 5 per cent of drinking water samples collected exceeded the 10 µg/L prescribed concentration or value (PCV) for arsenic. However, these results alone don't tell the full story of population exposure to arsenic in the region and to go a step further in assessing exposure, a HBM study is being carried out. The new study is a collaboration between the British Geological Survey and the PHE, with the addition of the University of Manchester. This study showed a good correlation between water quality and human internal exposure. This study further illustrated the application of HBM: a major public communication campaign was launched giving advice on alternatives to drinking water and way to reduce exposure.

Occupational HBM Guidance values are published by the UK Health and Safety Executive (HSE) in a document called the - EH40<sup>iv</sup>. HSE also publish a freely available guide to HBM in the workplace<sup>v</sup>. The EH-40 contains a list of HBM guidance values, only lead HBM is a legal requirement as in the Control of Lead at Work regulations (CLAW). HSE are a very active partner in the occupational studies in HBMEU and are advocates for the development of HBM - HBGVs for the occupational and environmental settings.

The Health Protection Agency (now part of PHE) led the UK component of COPHES/DEMOCOPHES. Samples of urine and hair were taken from mother-child pairs using a school setting. Exposure to **phthalates, environmental tobacco smoke, cadmium and mercury** were assessed. There were many lessons learnt from this study: recruitment of volunteers is very hard starting from a de-novo population, gaining trust requires a lot of effort, even non-invasive samples are not straight forward there are social biases to consider. Ethical constraints on the communication of results to the participants is also a consideration<sup>vi</sup>. PHE lead for the UK as Grant Signatories and NHCP in HBM4EU. HSE are key partners as stated above. The aim was to establish a population-based evaluation of the

	<p>priority chemicals, but funding proved to be difficult (discussed below). PHEs Linked Third parties were integral in much of HBM4EU - occupational studies (HSE and IOM), mixtures case studies and recommendations (Brunel University London).</p>
<ul style="list-style-type: none"> <li>• Description of HBM programme <b>if it exists</b> e.g. implementation of a HBM module into HES</li> </ul>	<p>Currently there is no National HBM programme in the UK. There are many cohort studies and studies based in hotspots which have used HBM to determine exposure - effect relationships. However, what is missing is robust background data. We still have no database of environmental exposure to compare 'events or incidents' to. This means for every study a control population must be sourced or other forms of comparison are carried out.</p> <p>The Health Survey for England (HSfE) monitors trends in the nation's health and care, providing information about adults aged 16 and over, and children aged 0 to 15, living in private households in England. Each survey includes core questions (e.g. about smoking, alcohol, general health); measurements such as height, weight, and blood pressure; and analysis of blood and saliva samples. In addition, there are question modules on specific topics that vary from year to year. The HSfE started in the 1980's and has only assessed environmental exposure to lead on the late 80's. We have been negotiating the inclusion of a HBM module for many years and have finally been successful. After many years of discussion, we have finally been able to include HBM into the HSfE and this was initially due to potential funding from HBM4EU.</p> <p>There was great interest from government departments (as described below). These departments were willing to provide a contribution to the 50% co-financing required. Unfortunately, the amount of funds required were not met and the timescales meant we were not able to implement this study within the framework of HBM4EU.</p> <p>In 2021, PHE secured funding through the Health Protection Research Units and a 'dress rehearsal' has been completed. The main study will start sample collection in 2022 and the data should be ready to publish in 2023.</p> <p>We will assess exposure to phthalates, PFAS, brominated flame retardants, bis-phenols and metals including lead. These chemicals are of concern to the UK and are also on the priority lists for HBM4EU. SOPs and material from HBM4EU have been used to ensure the data is as comparable as possible with the wider HBM4EU data.</p>
<ul style="list-style-type: none"> <li>• Describe which ministries (Environment, Health etc.)/policy</li> </ul>	<p>The UK (English) National Hub (NH) was formed as a response to the needs of HBM4EU.</p>

<p>makers and stakeholders involved/steering/financing the HBM programme.</p> <ul style="list-style-type: none"> <li>• Give examples - specific chemicals or outcomes.</li> </ul>	<p>Defra are the UK government department (ministry) responsible for chemical policy in the UK. A Defra Senior Policy lead represented the UK on the HBM54EU Governing Board and this same person Chaired the UK NH. Defra did not co-fund HBM4EU.</p> <p>The co-funding for HBM4EU was provided by Public Health England (PHE are as of 1<sup>st</sup> of October the UK Health Security Agency (UKHSA)). PHE were also the Grant Signatory and lead the NH activities.</p> <p>The Environment Agency is an executive agency of Defra and were very active on the NH and gave input the chemical prioritisation process for the UK NH. The EA have a legal requirement to monitor environmental contaminants in the environment - soil, ground water and biota. This data is of great value when determining which chemicals are of concern in environmental protection.</p> <p>The Food Standards Agency (FSA) is the UK equivalent of the European Food Standards Authority (EFSA). The FSA and PHE carryout an annual National Diet and Nutrition Survey (NDNS), this survey is used to estimate the intake of contaminants via the diet and the data produced is useful for source apportionment.</p> <p>Both EA and FSA are part of the UK NH but do not fund its activities. They provide a means of obtaining a more holistic view of chemicals in the UK environment and diet.</p> <p>The Health and Safety Executive (HSE) is responsible for occupational health as well as being the Competent Authority for UK REACH, and lead for Biocide and Pesticides regulations. HSE is an active partner in HBM4EU - leading on all the occupational activities. HSE are in the UK NH as partners and as policy leads for occupational health.</p> <p>In addition, the UK HBM4EU Linked Third parties are also part of the UK NH.</p> <p>In summary UK NH is Chaired by Defra, with partners from all UK Government agencies and departments with a chemical remit (PHE, EA, FSA, and HSE), plus all the academic partners in HBM4EU.</p>
<ul style="list-style-type: none"> <li>• Steps/processes needed or used to get the attention of policy makers.</li> </ul>	<p>The profile of HBM has been raised in the UK through calls for its implementation to protect public health on the political platform. Noteworthy, high profiles calls date back to 2018 when the Chief Medical Officer in the Annual Report recommended “I recommend Public Health England explore the creation of an English health biomonitoring data set, which includes human exposure to pollutant and health outcomes, and report publicly on their findings”.</p> <p>Additionally, the report recommended “Public Health England develop and embed a formal, structured programme of surveillance on the health impacts of</p>

	<p>pollution and regularly publish findings... and ... works to bring together all of the routinely produced data on the health impacts of pollution and the surveillance of pollution (including data held by local authorities, the Environment Agency and others), to ensure availability for the public, public sector and researchers”.</p> <p>In July 2019 the Environment Audit Committee (EAC) published “Toxic chemicals in everyday life” in which it stated “We need to better understand which chemicals we are exposed to in greatest measure and what the risk from that exposure is. To do this, a long-term, UK wide, human and wildlife biomonitoring programme should be established. The Chemicals Strategy should include objectives and priority areas for monitoring”.</p> <p>Given UK’s exit from the EU and the development of a UK-REACH, government agencies such as UKHSA (formerly PHE), Defra, EA, FSA and EA are working together to establish a mechanism to evaluate chemicals in a full-life cycle analysis; including human exposure assessment.</p> <p>The Prime Minister identified the protection and enhancement of the natural environment as a central priority for the Government as part of delivering its manifesto pledge to “to be the first generation to leave the environment in a better state than we inherited it”. The 25 Year Environmental Plan (A Green Future: Our 25 Year Plan to Improve the Environment) was published in January 2018 and included a key goal to produce an overarching UK Chemicals Strategy. One of the indicators developed to evaluate the success of this plan and report progress to Parliament relates to the management of exposure to chemicals. Even though it remains difficult to quantify the impacts of environmental chemicals in terms of morbidity and mortality or social costs, human biomonitoring data will provide evidence needed to monitor and evaluate the success of the UK Chemicals Strategy.</p>
<ul style="list-style-type: none"> <li>Describe barriers e.g funding; challenges e.g. participant recruitment; opportunities e.g. enhancing cross government working and linking of env data with exposure measurements currently at play in your country with regards to HBM.</li> </ul>	<p>Attempts have been made to add ‘environmental chemical’ exposure estimates to cohorts and to access stored (biobanked human tissue samples) this has to date not been successful. This does show the possibilities in the UK. The main barrier is funding. In addition, trying to add modules to already established cohort studies that are not within the control of PHE proved difficult. The only opportunity is to access stored samples - this has limitations in that there is no possibility to record environmental exposure risk factors. To illustrate this issue three cohorts where some environmental data is recorded are given below.</p> <p><u>Born in Bradford</u><sup>vii</sup>: cohort established in 2007 to examine how genetic, nutritional, environmental, behavioural, and social factors impact on health and development during childhood, and subsequently adult life in a deprived multi-</p>

<ul style="list-style-type: none"> <li>Have any of these barriers been addressed by HBM4EU? If yes - describe.</li> </ul>	<p>ethnic population. Between 2007 and 2011, detailed information on socio-economic characteristics, ethnicity and family trees, lifestyle factors, environmental risk factors and physical and mental health has been collected from 12 453 women with 13 776 pregnancies (recruited at ~28 weeks) and 3448 of their partners. Bradford is a town in the Midlands with a multi ethnic community and a relatively low socio-economic status (SES).</p> <p><u>Avon Longitudinal Study of Parents and Children (ALSPAC)<sup>viii</sup></u>: The ALSPAC study is sometimes referred to as the Children of the 90s Study. This is a cohort study of children born in the county of Avon, England during 1991 and 1992. It is used by researchers in health, education and other social science disciplines. It is now in its 30<sup>th</sup> year and the children have grown up. Children of the original children are being recruited. Samples from this cohort have been use for the human genome project. The cohort is based in a more affluent area where the SES is higher. Few determinants of environmental exposure have been carried out.</p> <p><u>UK Biobank<sup>ix</sup></u> is a large-scale biomedical database and research resource, containing in-depth genetic and health information from half a million UK participants, started in 2006. The database is regularly augmented with additional data and is globally accessible to approved researchers undertaking vital research into the most common and life-threatening diseases. It is a major contributor to the advancement of modern medicine and treatment and has enabled several scientific discoveries that improve human health. During its conception there were detailed debates about the collection of additional bio-samples and auxiliary information to allow for environmental exposure assessment this was again regarded as too expensive and the additional funds could not be found.</p> <p>HBM4EU has increased the political awareness and an understanding of the value of HBM as a tool in public health protection as well as chemical management. HBM4EU enabled the setting-up of a UK HBM Steering Group (including PHE, Defra HSE, FSA, and EA). This group has enabled dialogue and joint working in monitoring of environmental matrices and biomonitoring of environmental and human samples.</p>
<ul style="list-style-type: none"> <li>Other players who would be beneficial in raising awareness and working</li> </ul>	<p>The UK Chemicals Stakeholder Forum (UKCSF) enables discussion between stakeholders, government and regulators in support of effective chemicals and waste management. This forum includes key industry representatives, trade associations, and environmental NGOs. The full list is available on the web page<sup>x</sup>.</p>

<p>together to promote HBM</p>	<p>One of the goals of the forum is to provide an open and trusting environment to support open dialogue and strong engagement between stakeholders Industry - this is a very important forum.</p> <p>In June 2019<sup>xi</sup>, PHE presented the work of HBM4EU including the strategy to develop priorities and a request for data. The forum members were very positive and were enthusiastic about having an ongoing dialogue.</p> <p>Other groups which is missing at present are Science Communication experts and behaviour scientists, these groups would really add to the success in developing policy and communication material.</p>
<p><b>Future plans -</b></p> <ul style="list-style-type: none"> <li>• Are there plans to use HBM data in the future for policy or awareness - give clear examples. Will the data from HBM4EU be used?</li> </ul>	<p>PHE (which as of the 1<sup>st</sup> of October 2021 moved into the UK Health Security Agency (UKHSA)), will continue to develop HBM for public health protection and chemical management. Initially this will be through the work with HSfE and input to PARC.</p> <p>There are government calls for funding where we will continue to advocate the establishment of a sustained HBM programme.</p> <p>We will continue to engage the wider stakeholder through the UK Chemical Stakeholder Forum.</p> <p>The data from HBM4EU will be used as a comparator for the UK data produced.</p>

<sup>i</sup> Dioxins in city may be worst case in UK | UK news | The Guardian

<sup>ii</sup> (16) (PDF) Does long term residency near industry have an impact on the body burden of polychlorinated dibenzo-p-dioxins, furans, and polychlorinated biphenyls in older women? 2006 Occupational and Environmental Medicine 62(12):895-901 DOI: 10.1136/oem.2004.018754 (researchgate.net)

<sup>iii</sup> EU Ministers give blood for chemical check up | WWF (panda.org)

<sup>iv</sup> EH40/2005 Workplace exposure limits (hse.gov.uk)

<sup>v</sup> <https://www.hse.gov.uk/pubns/books/hsg167.htm>

<sup>vi</sup> Exley et al, Pilot study testing a European human biomonitoring framework for biomarkers of chemical exposure in children and their mothers: experiences in the UK, Environ Sci Pollut res. 2014, DOI 10.1007/s11356-015-4772-4

<sup>vii</sup> Cohort Profile: The Born in Bradford multi-ethnic family cohort study. John Wright et al. International Journal of Epidemiology, Volume 42, Issue 4, August 2013, Pages 978–991, <https://doi.org/10.1093/ije/dys112>

<sup>viii</sup> <http://www.bristol.ac.uk/alspac/>

<sup>ix</sup> <https://www.ukbiobank.ac.uk/>

<sup>x</sup> <https://www.gov.uk/government/groups/uk-chemicals-stakeholder-forum>

<sup>xi</sup>

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/840420/ukcsf-76-190605.zip](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/840420/ukcsf-76-190605.zip)