Group 1 National Hub Template (HBM data for Awareness)

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Introduction:	
• Background information on the evolution and status of HBM in your country e.g COPHES/DEMOCOPHES and EU programs.	HBM has been part or research activities in Luxembourg for the last 15 years, the major focus being on exposure biomarkers and the development of related methods in hair as minimal invasive sampling matrix. In the domain of occupational medicine, HBM has been used throughout the years to monitor the health of workers. HBM analyses for heavy metals are a historical strength of the Laboratoire national de santé (LNS) since 20 years. All HBM in the organic domain, however, was outsourced to the neighbouring countries until 2019. With regard to the domain of environmental health, Luxembourg has participated in the COPHES/DEMOCOPHES initiative with 60 mother-child pairs. This initiative was a joint collaboration between the previous institute Gabriel Lipmann and the LNS. Aside from the COPHES/DEMOCOPHES initiative, any science-policy translation of HBM in the domain of environmental health has been lacking until mid-2018 in Luxembourg.
Main text - Results and Discussion ENSURE YOUR NARRATIVES ARE REFERENCED AS FAR AS POSSIBLE	
• Description of issue(s) which have resulted in the raising of awareness. • Include brief description of sample population, substances of concern and whether local/regional/national. • Give example of cases and specific studies	Beginning of 2018, the LNS and the Ministry of Health, as its “ministère de tutelle”, decided to appoint a MD-Specialist as head of the Department Health Protection. The LNS has as explicit mission to offer the best service in public health and health care to the population and the patients, including teaching and research. More specifically, the Department Health Protection is in charge of the chemical and microbiological analyses for the national food control (human food chain), the national indoor pollution surveillance programs, and part of the analyses in occupational health surveillance. As such, a major strategic objective was added for the Department Health Protection, i.e. to develop the medical, epidemiological and toxicological expertise in the domains of environmental and occupational health. From half 2018 onward, Luxembourg started to involve more and more actively in the HBM4EU initiative. We joined the consortium as one of the last Partners, but have become very active in several domains since then.

	The combination of the European framework and initiatives, offered via HBM4EU, in parallel with the appointment of a MD-Specialist as driving force at the level of the national health institute, has boosted exponentially the implementation of HBM in the domain of environmental health in Luxembourg. Luxembourg is now participating in the health risk assessment in WP5, the aligned studies in WP8 (Task 8.1), the new analyses of the DEMOCOPHES bio-banked samples in WP8 (Task 8.2), and the Chromate and E-waste studies in WP8 (Task 8.5). For Task 8.1, the LNS is collaborating with the Luxembourg Institute of Health for the bio-banked samples, the ethical permissions, and the post-harmonization of the questionnaires. Task 8.2 is the result of the close collaboration between the Luxembourg Institute for Science and Technology (LIST), who's PI was the former principal investigator of the COPHES/DEMOCOPHES initiative for Luxembourg, and the LNS that is in charge of the HBM science-policy initiatives in Luxembourg since mid-2018.
• Description of HBM programme if it exists e.g. implementation of a HBM module into HES or relevant other activities funded by the government.	(1) Mid-2018 – 2020: Setting-up of a Unit in charge of environmental/occupational analyses and human biological monitoring within the Department Health Protection. The Unit focuses on Indoor Pollution, Human Biological Monitoring, and Occupational Hygiene. Dr Radu Duca, a re-known expert in HBM has been attracted and is heading the Unit since August 2019. Under the supervision of Dr Duca, a MD-Biologist, a MSc in Chemistry and a PhD in Chemistry are in charge of the development of inorganic and organic exposure biomarkers, effect biomarkers, and the daily supervision of our technicians. (2) End 2020-2021: Setting-up of a Unit Medical Expertise and Data Intelligence within the Department Health Protection. This Unit is in charge of the medical and toxicological expertise and the set-up/running of epidemiological surveillance programs in the domains of environmental health/medicine and occupational health/medicine. (3) End of 2019 and beginning of 2020: HBM as support in occupational health surveillance. HBM used to monitor the workers in charge of the remediation works of the Pulvermühle site in Luxembourg. The Pulvermühle site was a heavily contaminated, old industrial site. HBM carried out by the LNS, under the supervision of the major occupational health service in Luxembourg (Service de Santé au Travail Multisectoriel STM) and of the Ministry of Health. Collaboration with the Ministry of Environment and the Labor Inspection.

	(4) Indoor pollution surveillance programs at national level: When a physician has a patient consulting with symptoms of which he/she suspects a potential relation with the indoor environment, the MD can write a medical prescription requesting detailed analyses of the patient's residency. After the authorization by the Ministry of Health, the LNS goes on-site to take the air, dust and surface samples, and proceeds with the chemical and microbiological analyses of the environmental samples. From mid-2022 onward, the indoor surveillance programs will be complemented systematically with a HBM-pillar as well as with questionnaires and interviews to collect the specific contextual and health information. To this purpose, LNS field sampling nurses will take urine, blood and hair samples of the patient and, if necessary, of some of the relatives living in the same residency during the on-site visits. This will allow us to build up reference databases that include information with regard to external exposure, internal exposure, potential confounders and health outcomes. By statistical analyses of these reference databases, we will be able to identify the priorities for Luxembourg, and to offer a better targeted care for the patient and a better targeted prevention for the Luxembourgish population. (5) Setting-up of a pregnancy cohort to investigate the impact of the pre-natal and early life indoor exposome on children's health. We will recruit pregnant mothers in the second trimester of their pregnancy and follow-up the children until the age of 12. We will focus on five health outcomes, i.e. (1) low birth weight, (2) respiratory outcomes, (3) cognitive impairment and neuro-cognitive development, (4) obesity and metabolic syndrome, and (5) pre-puberty. Recruitment is planned to start form the second half of 2022 onward and will start in the Hospital Centre Emile Mayrisch. This hospital has the legal mandate to develop the discipline of Environmental Medicine/Health in Luxembourg, as attributed by the Ministry of Health. (6) Introduction of an obligatory module on "Environmental and Occupational Risk Factors" in the second year of the Medical School in Luxembourg: HBM and the exposome are among the topics. The course will start from Feb 2022 onward.
• Describe which ministries (Environment, Health etc.)/policy makers and stakeholders	Ministry of Health Depending on the (nature of the) initiative, it is: • either the Ministry of Health alone that is involved, or

involved/steering/financing the HBM programme. • Give examples - specific chemicals or outcomes.	• there is a close collaboration among the Ministry of Health, the LNS, and other Ministries that have competences in the domain (for example the Ministry of the Environment, and in the future the Ministry of Labor because the domain of occupational medicine will be hosted by that Ministry in the near future). <u>Outcomes</u>: as defined above. <u>Chemicals:</u> For the national indoor pollution surveillance programs (see Point 4 above), the Ministry of Health has asked us to follow the AGOEF Indoor Pollution. With the new partnership PARC that is upcoming, we will do major efforts to include, if necessary, extra chemicals and this in order to align to a maximum with this European initiative.
• Steps/processes needed or used to get the attention of policy makers.	We are on track and things are progressively implemented now.
• 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. • Have any of these barriers been addressed by HBM4EU? If yes - describe.	I think that we can summarize our HBM4EU experience in the last 3.5 years (mid-2018 until end 2021) as follows: • A very active role of "HBM and HBM4EU ambassador" has been developing over the last years. • HBM4EU has been a major driver for initiatives in Luxembourg. • As National Hub, we would benefit from a more sustainable embedding of HBM at European level (regulation). The "project-based" approach is sometimes interpreted as a relative weakness by ministries, medical directors,….When reaching out to different partners, you need to convince then mainly as person of the added value of HBM for the respective core business of each partner.
• Other players who would be beneficial in raising awareness and working together to promote HBM	I think that it would be useful if the national hubs can have a more direct interaction, via HBM4EU or the future PARC initiative, to the actors involved from the EC and the different European bodies, such as ECHA and EFSA. This may allow to have a more visible and, if necessary, more intensive interaction in domains where we as National Hub have identified existing lacunes in our respective Member State. If we are all the time together with a huge group, it is often difficult to pinpoint intrinsic weaknesses or points that may be improved at Member State level.

	For example, and this is not to be included in the article as such (thank you, Lisbeth, for your understanding ☺). I know that EFSA is supportive of HBM, also in the domain of food monitoring. However, in our daily organization of food control in Luxembourg, our colleagues of the Ministry of Consumer Protection are mainly focusing on the organization of the food control as requested CURRENTLY by Europe. From a strategic point of view, it would be good if bodies as EFSA can be put forward more often during these initiatives so that it becomes clear that HBM is also within the future strategy of EFSA, and we can start preparing properly in order to be ready within XXX years, also at Member State level.
Future plans - • Are there plans to use HBM data in the future for policy or awareness - give clear examples. Will the data from HBM4EU be used?	See above.