Australian Academy of Health & Medical Sciences

10 July 2024

POLICY STATEMENT

ESTABLISHMENT OF A NATIONAL HUMAN BIOMONITORING PROGRAM

This policy statement from the Australian Academy of Health and Medical Sciences outlines the evidence and implementation information supporting two key recommendations made in our December 2024 submission to the Senate Inquiry into Per- and Polyfluoroalkyl substances (PFAS):[1]

Recommendation 1: Commit to establishing a national human biomonitoring (HBM) program to track Australians' bioaccumulation of PFAS together with other chemical contaminants.

Recommendation 2: Immediately establish an interim program that monitors pregnant women's levels of PFAS and other chemical contaminants while the HBM program is established.

Policy context and rationale

PFAS are a group of nearly 15,000 synthetic chemicals widely present in the environment – including in drinking water, food, and household products.[2,3] Known as "forever chemicals" due to their strong carbon-fluoride bonds, PFAS persist in the environment for decades and, through bioaccumulation, build up in human and animal bodies.[4,5]

PFAS are endocrine-disrupting chemicals that interfere with hormone function. Growing concerns have emerged around the potential health impacts of PFAS bioaccumulation, with early research highlighting the need for further investigation of possible links to immune and reproductive system disruptions, childhood neurodevelopmental disorders, and increased cancer risks.[3,6–8]

Ongoing uncertainty about the health risks of PFAS exposure is contributing to public anxiety in Australia, with communities facing higher exposure levels being more likely to experience psychological distress linked to perceived threats to their health.[9]

Confirming or quantifying the potential health risks of PFAS exposure is complex due to the need to track thousands of interacting chemicals–including PFAS chemicals, as well as bisphenols, phthalates, flame retardants, and pesticides–often present at low levels. These chemicals can accumulate and act in combination, but the effects of such complex chemical mixtures remain poorly understood.[10]

Addressing these challenges requires large-scale research that will only be possible through targeted, long-term monitoring of the levels of PFAS and other chemical contaminants present across all Australian communities.

Recommendation 1: Commit to establishing a national human biomonitoring program to track Australians' bioaccumulation of PFAS together with other chemical contaminants.

> **It is the position of the Australian Academy of Health and Medical Sciences that the Federal Government should implement a national human biomonitoring program of PFAS and other chemical contaminants.**
>
> **This will enable researchers to investigate whether there are connections between exposure levels and health outcomes and enable policymakers to develop evidence-based approaches if needed, such as public health interventions and communication strategies.**

Despite having some of the highest PFAS exposure levels globally, Australia stands out among comparable nations such as Canada, the US, Germany, South Korea, and Japan for not operating a population-level human biomonitoring (HBM) program.[11,12]

To identify the extent of PFAS bioaccumulation across the population, and then investigate possible connections between PFAS exposure and health outcomes, Australia must begin tracking levels of PFAS and related chemical contaminants that co-accumulate in the human body.

Environmental monitoring of PFAS is valuable, but it is not enough. What is missing is comprehensive data on how these environmental exposures translate into bioaccumulation in the human body. Without a HBM program, we lack the critical information needed to understand the extent of PFAS bioaccumulation across Australian communities and whether there are health impacts.

Case study | National Health and Nutrition Examination Survey (US)

The US operates one of the world's most comprehensive HBM programs through the National Health and Nutrition Examination Survey (NHANES). Since 1999, NHANES has provided nationally representative data on PFAS exposure in approximately 5,000 people aged 12 and over, tracking trends and informing national health policy.[13,14] Key PFAS chemicals such as perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA) have been detected in blood samples from nearly all participants.[15] NHANES data collection has been set up so that it can support regulatory decisions, risk assessment, and public health responses, with a robust design that captures high-risk groups.

Australia could benefit significantly from adopting a similarly comprehensive approach, enabling timely, evidence-based responses to chemical exposures across the population.

Implementation guidance:

- **Sample a randomised group of individuals annually:** This would establish population-level baseline exposure levels, making it possible to identify communities have unusually high bioaccumulation. The sample size should be identified through statistical analysis but would likely be smaller than the NHANES sample of 5,000. As research advances, individuals with significantly elevated PFAS levels could be recalled for follow-up testing, health assessments, or targeted interventions if warranted by emerging evidence.
- **Review existing Australian research efforts:** Examine studies such as the Australian National University PFAS Health Study and previous time- and scope-limited national HBM efforts (e.g. the National Health Measures Survey (2002-2003) and the Australian Human Biomonitoring Pilot Project (2020-2021)), to ensure that the HBM program builds on current knowledge and integrates insights from existing research approaches.[16,17]
- **Prioritise co-monitoring of multiple chemical contaminants:** Recognising the potential cumulative risks of chemical mixtures, HBM should include a range of chemical contaminants, such as PFAS, bisphenols, phthalates, flame retardants, and pesticides.
- **Ensure national representativeness and statistical power:** Use a multi-stage probability sampling design, as in the US NHANES model, to ensure that findings are generalisable to the Australian population and can identify trends and risks in high exposure or vulnerable subgroups.
- **Leverage existing national public health infrastructure:** Develop and implement the HBM program through an established national structure – such as the Australian Centre for Disease Control – to ensure coordination, efficiency, and integration with existing health surveillance and response systems.

- **Integrate biomonitoring into national health and policy planning:** Establish formal pathways for HBM data to inform, if needed, public health policy, chemical regulation, and risk assessment processes across government departments. Where appropriate, link HBM data to administrative datasets (e.g. Medicare Benefits Schedule, Pharmaceutical Benefits Scheme, and hospitalisation records) via the Australian Institute of Health and Welfare National Health Data Hub to support analysis of potential health impacts and guide targeted interventions.[16]

Recommendation 2: Immediately establish an interim program that monitors pregnant women's levels of PFAS and other chemical contaminants.

> **While Australia works to establish a comprehensive HBM program, the Australian Academy of Health and Medical Sciences recommends that the Federal Government immediately implements an interim program to monitor PFAS and other chemical exposures in pregnant women.**
>
> **This priority population is particularly vulnerable to the effects of endocrine-disrupting chemicals, and it is important to understand whether there are health implications for mothers and/or children.**

Australia is the only OECD country to not survey PFAS levels in pregnant women – despite this being a relatively straightforward measure to implement. While Australia works towards establishing a national, population-wide HBM program, it should begin monitoring PFAS and other chemical contaminants in pregnant women.

Collecting these data would allow Australian researchers to investigate potential links between gestational and infant exposure to mixtures of endocrine-disrupting PFAS and other chemicals, and child health outcomes. It is currently not clear whether such links exist, but it is important to establish the evidence needed to inform the public and enable evidence-based policy and communication approaches if needed. Early research again suggests there is a need to explore whether such exposure could be associated with disrupted neurodevelopment, but this research can only proceed once robust, population-level exposure data are available.[8,10,18]

Case study | Maternal-Infant Research on Environmental Chemicals (Canada)

Canada provides a strong model for interim PFAS monitoring through its Maternal-Infant Research on Environmental Chemicals (MIREC) Study, led by Health Canada since 2008.[19] This national cohort study tracks environmental chemical exposure in the same group of pregnant women and their children over time, collecting biospecimens throughout pregnancy and early childhood.[20] The program monitors over 200 substances, including PFAS, heavy metals, pesticides, flame retardants, and plasticizers.[21]

Critically, MIREC data is set up so that it can directly inform Canadian public health policy, including chemical risk assessments, drinking water guidelines, and international reporting obligations.[22]

A similar, targeted initiative in Australia could yield vital data on gestational PFAS exposure, enabling timely health research and supporting evidence-based protections for vulnerable populations, if needed.

Implementation guidance

- **Review existing Australian birth cohort studies:** Examine studies such as the Barwon Infant Study and Generation Victoria to inform the design and implementation of an interim biomonitoring program for pregnant women.[23,24]
- **Leverage existing antenatal testing pathways to minimise burden and cost:** PFAS testing could be readily integrated into the routine gestational diabetes blood tests conducted at 24-28 weeks of pregnancy for all Australian women.[25]
- **Ensure informed consent and culturally appropriate communication:** Clear, evidence-informed protocols for obtaining consent and explaining the purpose of PFAS testing should emphasise that this is not diagnostic, helping to reduce unnecessary anxiety and support informed, confident participation.
- **Integrate PFAS monitoring into established maternal and child health data systems:** Use systems such as the National Perinatal Data Collection, to streamline data collection and enable linkage with long-term health outcomes.
- **Enable follow-up studies:** Ensure the interim program is designed to facilitate future long-term follow up of mothers, and work with the National Health and Medical Research Council to fund this longitudinal research into potential health impacts of early-life chemical exposure. It would be valuable to include fathers in future studies to explore potential associations between paternal PFAS exposure and child health outcomes.

Authorisation

This statement was endorsed by the Australian Academy of Health and Medical Sciences' Executive on 10 July 2025.

References

1. Australian Academy of Health and Medical Sciences. Submission to the Inquiry into PFAS (per- and polyfluoroalkyl). Published online December 2024. Accessed July 4, 2025. https://aahms.org/policy/aahms-calls-for-a-national-biomonitoring-program-to-track-the-health-impacts-of-forever-chemicals/

2. NHMRC. NHMRC Statement: Per- and polyfluoroalkyl substances (PFAS) in drinking water. Website of the National Health and Medical Research Council. 2024. Accessed November 20, 2024. https://www.nhmrc.gov.au/health-advice/environmental-health/water/PFAS-review/NHMRC-statement-PFAS

3. Zahm S, Bonde JP, Chiu WA, et al. Carcinogenicity of perfluorooctanoic acid and perfluorooctanesulfonic acid. *Lancet Oncol*. 2024;25(1):16-17. doi:10.1016/S1470-2045(23)00622-8

4. ABC. PFAS "forever chemicals" are all around us. What does it mean for our health? Website of the Australian Broadcasting Corporation. 2024. Accessed November 20, 2024. https://www.abc.net.au/news/health/2024-09-19/pfas-forever-chemicals-health-impacts-water-food-environment/104358572

5. NIEHS. Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS). Website of the National Institute of Environmental Health Sciences. 2024. Accessed November 20, 2024. https://www.niehs.nih.gov/health/topics/agents/pfc

6. Wang LQ, Liu T, Yang S, et al. Perfluoroalkyl substance pollutants activate the innate immune system through the AIM2 inflammasome. *Nat Commun*. 2021;12(1):2915. doi:10.1038/s41467-021-23201-0

7. Li L, Guo Y, Ma S, Wen H, Li Y, Qiao J. Association between exposure to per- and perfluoroalkyl substances (PFAS) and reproductive hormones in human: A systematic review and meta-analysis. *Environ Res*. 2024;241:117553. doi:10.1016/j.envres.2023.117553

8. Stübner C, Nielsen C, Jakobsson K, Gillberg C, Miniscalco C. Early-Life Exposure to Perfluoroalkyl Substances (PFAS) and Child Language and Communication Development: A Systematic Review. *Int J Environ Res Public Health*. 2023;20(24):7170. doi:10.3390/ijerph20247170

9. Lazarevic N, Smurthwaite KS, Batterham PJ, et al. Psychological distress in three Australian communities living with environmental per- and polyfluoroalkyl substances contamination. *Science of The Total Environment*. 2023;874:162503. doi:10.1016/j.scitotenv.2023.162503

10. Caporale N, Leemans M, Birgersson L, et al. From cohorts to molecules: Adverse impacts of endocrine disrupting mixtures. *Science (1979)*. 2022;375(6582). doi:10.1126/science.abe8244

11. Sonne C, Desforges JP, Gustavson K, et al. Assessment of exposure to perfluorinated industrial substances and risk of immune suppression in Greenland and its global context: a mixed-methods study. *Lancet Planet Health*. 2023;7(7):e570-e579. doi:10.1016/S2542-5196(23)00106-7

12. Zare Jeddi M, Hopf NB, Louro H, et al. Developing human biomonitoring as a 21st century toolbox within the European exposure science strategy 2020–2030. *Environ Int*. 2022;168:107476. doi:10.1016/j.envint.2022.107476

13. CDC. National Health and Nutrition Examination Survey (NHANES) - Health, United States. Accessed July 3, 2025. https://www.cdc.gov/nchs/hus/sources-definitions/nhanes.htm

14. CDC. How People Use NHANES Data | National Health and Nutrition Examination Survey | CDC. 2024. Accessed July 3, 2025. https://www.cdc.gov/nchs/nhanes/publications/uses-of-data.html

15. Continuous NHANES Web Tutorial: Specifying Sampling Parameters: Key Concepts about NHANES Survey Design. Accessed July 3, 2025. http://medbox.iiab.me/modules/en-cdc/www.cdc.gov/nchs/tutorials/nhanes/SurveyDesign/SampleDesign/Info1.htm

16. Kirk M, Korda R, Clements A, et al. The PFAS Health Study Phase II Research Protocols. Published online 2018. Accessed July 7, 2025. https://nceph.anu.edu.au/sites/prod.nceph.sca-lws06.anu.edu.au/files/ANU-per-and-poly-fluoroalkyl-substances-health-study-phaseII-research-protocol.pdf#:~:text=The%20Per%20and%20Poly-Fluoroalkyl%20Substances%20%28PFAS%29%20Health%20Study%3A,Queensland%20%28Qld%29%20and%20Katherine%2C%20Northern%20Territory%20%28NT%29%2C%20Australia.

17. Taucare G, Chan G, Nilsson S, et al. Temporal trends of per- and polyfluoroalkyl substances concentrations: Insights from Australian human biomonitoring 2002-2021 and the U.S. NHANES programs 2003-2018. *Environ Res*. 2024;262(Pt 1):119777. doi:10.1016/j.envres.2024.119777

18. Symeonides C, Vacy K, Thomson S, et al. Male autism spectrum disorder is linked to brain aromatase disruption by prenatal BPA in multimodal investigations and 10HDA ameliorates the related mouse phenotype. *Nat Commun*. 2024;15(1):6367. doi:10.1038/s41467-024-48897-8

19. MIREC. Maternal-Infant Research on Environmental Chemicals (MIREC). Accessed July 3, 2025. https://www.mirec-canada.ca/en/the-mirec-study

20. Maelstrom Research. MIREC - Maelstrom Research. Accessed July 3, 2025. https://www.maelstrom-research.org/study/mirec

21. Maternal-Infant Research on Environmental Chemicals (MIREC) Study Research Platform - Canada.ca. Accessed July 3, 2025. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/environmental-contaminants/human-biomonitoring-environmental-chemicals/maternal-infant-research-environmental-chemicals-mirec-study.html

22. Government of Canada. The Canadian Health Measures Survey: How Our National Biomonitoring Survey Helps Us Stay Healthy. 2019. Accessed July 3, 2025. https://science.gc.ca/site/science/en/blogs/science-health/canadian-health-measures-survey-how-our-national-biomonitoring-survey-helps-us-stay-healthy

23. Barwon Health. Barwon Infant Study. 2024. Accessed July 7, 2025. https://www.barwonhealth.org.au/service/barwon-infant-study/

24. GenV - Generation Victoria. Accessed July 9, 2025. https://www.genv.org.au/

25. Healthdirect Australia. Routine antenatal tests. November 2023. Accessed July 4, 2025. https://www.healthdirect.gov.au/routine-antenatal-tests