NSW Health

NSW Health Expert Advisory Panel on PFAS

Recommendations – August 2025

Introduction

This report outlines the recommendations of the NSW Health Expert Advisory Panel on PFAS. The NSW Chief Health Officer convened the panel to provide advice on the current evidence and guidance related to the potential health effects of per- and polyfluoroalkyl substances (PFAS).

PFAS are a class of manufactured chemicals that have been used since the 1940s to make products that resist heat, stains, grease, and water. Their persistence in the environment and potential health effects have become a growing concern across Australia and internationally.

Panel membership was drawn from a range of disciplines to ensure breadth of expertise. The panel membership included clinical expertise across toxicology, primary care, public health, pathology, oncology, cardiology and endocrinology and academic expertise across risk communication and applied epidemiology. For further information, refer to the Terms of Reference[1].

An independent consultant was engaged to collate the available evidence in Australia and internationally and support the panel deliberations. Additional focused discussions on risk communication were arranged out of session with specific experts and the outcomes were deliberated with the panel.

This report summarises the key recommendations of the panel on:

- The evidence of health effects,
- The role of epidemiological studies for health outcomes in potentially affected communities,
- Any clinical utility of blood testing in communities with PFAS exposure,
- How to communicate the risks to these affected communities and health care providers in the context of evolving evidence, and
- Future priorities for research and investigation of PFAS.

Refer to the Glossary for definitions of key terms used in this document.

Summary of recommendations

Based on an assessment of available evidence the expert panel drew the following conclusions and made the following recommendations:

1. Health effects of PFAS

1.1 The body of research for health effects related to PFAS is large and still growing. Based on the substantial research already undertaken, the health effects of PFAS appear to be small.

2. Methods for setting exposure threshold levels

2.1 Authorities should avoid using currently available human epidemiological studies to derive threshold levels due to the higher risk of bias and confounding.

3. Role of epidemiological studies for health outcomes

3.1 For epidemiology studies to contribute positively to our understanding of PFAS and provide reliable information about a clinical effect caused by PFAS, it is essential that:

- the exposure is well characterised,
- confounders are measured and accounted for, and
- the population is large enough to detect a clinical effect.

3.2 These characteristics are not currently met in the Blue Mountains population or in other communities in NSW.

4. Clinical utility of blood testing

4.1 At present, there is no clinical benefit for an individual to have a blood test for PFAS.

4.2 The National Academies of Science Engineering and Medicine (NASEM) blood levels are not appropriate to guide clinical management.

4.3 Should a health care provider order a blood test for PFAS for a patient, the health care provider should provide clear contextual information about the test and its limitations to the patient, to manage expectations and avoid misinterpretation. The health care provider should also offer these patients age-appropriate preventative health screening in line with current recommendations. Such recommendations should be made independent of the patient's PFAS level.

5. Interventions to reduce PFAS in blood

5.1 Interventions that reduce blood PFAS are of uncertain benefit and may cause harm.

5.2 Clinicians can support patients concerned with their serum PFAS levels by engaging in usual preventative health interventions, as many of the health conditions potentially associated with PFAS are common in the community and are associated with well-established risk factors.

6. How to communicate risk in the context of evolving evidence

6.1 Communication should be tailored to the diverse levels of concern in the community and should ensure continued transparency.

6.2 Communication methods may include small group engagement, trusted messengers, clinician support, clear public messaging and media engagement. Channels for community feedback should be identified.

6.3 NSW Health should review communication tools and content, to better support community and clinicians.

7. Future priorities for research

7.1 It is important to monitor, interpret and act on relevant evidence as it emerges globally.

7.2 NSW Health should assist clinicians and community leaders to support their communities to interpret the evidence about potential effects of PFAS exposures.

7.3 Representative population-based biomonitoring, such as the National Health Measures Survey[2], may be of value to continue to monitor changes in PFAS exposure in the Australian population.

1. Health effects of PFAS

On health effects, the panel concluded that:

- Various study designs have been used in human health and toxicological studies of PFAS chemicals globally, and all have limitations that may result in risk being underestimated or overestimated.
- Studies have reported an association between PFAS exposure and high cholesterol, reduced kidney function, changes to the immune system (including lower antibody response to vaccines), changes to hormone levels, changes in liver enzymes, changes to menstruation, lower birthweight, high blood pressure in pregnancy and some cancers. However, the panel noted that:
    - There are inconsistent findings across different studies with limited evidence of a dose-response relationship,
    - The amount of PFAS measured in some studies was low, similar to levels found in the general population. These studies are unable to distinguish any effects of PFAS from the many other factors that can affect health.
    - There have been few high-quality studies of workers exposed to high levels of PFAS, and
    - Many studies cannot adequately control for bias and confounding, and chance may play a role in findings.
- There are multiple confounders that need to be accounted for (e.g. smoking, diet and age) in assessing whether PFAS causes health effects.
- In some studies, health effects associated with PFAS may instead result from factors such as poor kidney function. PFAS are partly excreted by the kidneys. This means people with poor kidney function will have higher levels of PFAS, which may result in apparent associations between PFAS and other health conditions.

Specifically on cancer effects, the panel concluded that:

- Given community concern about the risk of cancer, and in the light of the International Agency for Research on Cancer's (IARC) review of PFAS[3], the panel took particular care to scrutinise the evidence related to cancer risk. The panel was confident that the absolute cancer risk from PFAS was low based on the human epidemiological studies and levels of exposure in the Australian population.
- The IARC assessed whether perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) were cancer causing. IARC's reviews examine whether chemicals, foods, or other environmental agents are cancer hazards (that is, they have the ability to cause cancer). IARC currently classifies 135 agents as cancer causing (Group 1 agents), including alcoholic beverages, processed meat and wood dust*.
- It should be noted that IARC does not identify a threshold at which a hazard may cause cancer, or a dose-response relationship (the more you are exposed to a substance, the greater the risk of harm), or the magnitude of effect (how big the risk is).
    - The IARC found PFOA to be cancer causing due to sufficient evidence for cancer in experimental animals and strong evidence of a mechanism of action. IARC found some evidence from human studies that PFOA caused renal cell and testicular cancer, but the evidence was not strong. For other types of cancer, there was little epidemiological evidence in human studies of a connection between PFAS and an increased risk of cancer.

* For the full list, refer to: https://monographs.iarc.who.int/agents-classified-by-the-iarc/

- IARC found PFOS to be possibly cancer causing. There was no adequate evidence in human studies and limited evidence in animal studies. However, it was given this classification because of strong evidence of a mechanism of action.

The panel recommended:

1.1 The body of research for health effects related to PFAS is large and still growing. Based on the substantial research already undertaken, the health effects of PFAS appear to be small.

2. Methods for setting exposure threshold levels

On exposure threshold levels the panel concluded that:

- Threshold levels indicate the PFAS level below which there is not expected to be any harm, for example in water and food.
- Regulators use a scientific process to derive threshold levels. They can use different approaches to derive thresholds that can result in markedly different threshold values.
- The current practice in Australia for setting thresholds, for example those used by Food Standards Australia New Zealand (FSANZ) in relation to food safety thresholds and National Health and Medical Research Council (NHMRC) in relation to water quality thresholds, is based on animal studies with appropriate safety factors.
- This approach was used by NHMRC in the development of health-based guideline levels for PFAS in the *Australian Drinking Water Guidelines*[4]. The *Australian Drinking Water Guidelines* threshold levels are very conservative, consider the Australian context and conditions, and include a range of safety factors which always err on the side of caution.
- To calculate these threshold levels, the NHMRC did not consider the available studies in humans to be sufficiently reliable or appropriate, unlike some other international agencies[5]. The panel concurred that, based on current epidemiological evidence, the approach used by the NHMRC is the most appropriate approach for establishing threshold levels.

The panel recommended:

2.1 Authorities should avoid using currently available human epidemiological studies to derive threshold levels due to the higher risk of bias and confounding.

3. Role of epidemiological studies for health outcomes

The panel concluded that:

- Population blood testing has two potential purposes: measuring exposure in the population and identifying potential health effects of exposure to PFAS.
- The Australian National University (ANU) PFAS Health study[6] (2021) attempted to assess the impact of PFAS exposure in affected communities. It showed there was clear evidence of elevated blood serum concentrations of PFAS in residents and workers in three PFAS-affected communities compared to three populations not thought to be PFAS-affected. Whilst there was definite evidence of increased psychological distress in the three exposed communities, evidence for other adverse health outcomes from this study was limited.
- The Australian Bureau of Statistics (ABS) Per- and polyfluoroalkyl substances report[2] (2025) offers information to help contextualise individual blood test results. It reports serum levels of 11

types of PFAS in the Australian population, including the three main PFAS used in aqueous fire-fighting foams (PFOA, PFOS, perfluorohexane sulfonic acid [PFHxS]). PFOS and PFOA were detected in over 95% of people tested, suggesting there are multiple sources of exposure to PFAS. The ABS reported that PFAS levels in humans in Australia, North America and Europe have been declining in the last two decades.

- To be able to draw accurate conclusions about the impact of PFAS on health, a study requires a gradient of exposure (some people exposed more, some people exposed less), biologically plausible levels of exposure (sufficiently high levels to cause a measurable effect) and a large population sample (sufficiently large number of people).
- Population studies would need to appropriately account for bias and confounders including age, renal function, smoking, diet, weight, and physical activity, which are well established to have strong associations with cancer risk and other health effects.

The panel recommended:

3.1 For epidemiology studies to contribute positively to our understanding of PFAS and provide reliable information about a clinical effect caused by PFAS, it is essential that:

- the exposure is well characterised,
- confounders are measured and accounted for, and
- the population is large enough to detect a clinical effect.

3.2 These characteristics are not currently met in the Blue Mountains population or in other communities in NSW.

4. Clinical utility of individual blood testing for PFAS

On the role of individual blood tests, the panel concluded that:

- While clinical testing for PFAS is commercially available, the current scientific evidence indicates that there is there is no clinical benefit for an individual to have a blood test for PFAS. The reasons for this include:
  - PFAS blood tests are difficult to interpret and are unlikely to guide medical care. This is because PFAS will be detected in most people, there are many different PFAS types and blood levels do not predict any current or future health outcomes.
  - PFAS blood test results can cause unnecessary concern, and subsequent interventions may cause harms.

In reaching their conclusions, the panel noted:

- Feedback from community engagement sessions that community members expressed the “right to know” for people living in areas where PFAS exposure may have occurred.
- The panel's recommendations differ from those of the National Academies of Science Engineering and Medicine (NASEM). NASEM, an independent institution in the United States (US), published Guidance on PFAS Exposure, Testing and Clinical Follow-up[7] in 2022. In this guidance document, NASEM provided recommendations on individual blood testing and the use of blood levels to inform clinical care.
- NASEM used human health and epidemiological studies to derive these blood levels. These studies are limited by small effect sizes, potential bias, confounding, and in some studies, intermediate outcomes of uncertain relevance. The different approaches that NASEM used to derive these blood levels is further described in the panel agenda papers[8].

- The US Centers for Disease Control and Prevention (CDC) has noted the work of NASEM but has interpreted the weight of evidence differently to NASEM. In 2024, the Agency for Toxic Substances and Disease Registry (ATSDR) (the agency that works to minimise health risks associated with exposure to hazardous substances and which is overseen by the Director of the CDC) issued a summary of its different appraisal of the evidence[9]. ATSDR gives advice to clinicians on managing and evaluating PFAS exposure and has not adopted NASEM's recommendations on individual blood testing and health-based screening based on PFAS blood levels.
- In addition, a 2024 editorial in *Toxicology Communications* highlighted unresolved issues in NASEM's report that impact the report's findings[10]. The authors acknowledged the importance of thoughtful consideration of the emerging evidence in an area of significant concern to the community, as undertaken by NASEM. However, issues identified in NASEM's findings include:
    - the recommended summed PFAS serum levels are not appropriate for individualised health risk assessment,
    - most of the recommended post-testing clinical management is standard primary care practice that should occur for all patients regardless of PFAS exposure,
    - there are limitations in the cancer screening methods recommended by the report, with associated risk of harms to the patient, and
    - there was no input of medical toxicologists to NASEM's guidance document.
- NASEM recommended investigations for potential health effects at total PFAS levels above a certain blood level. It is highly likely that many Australians will have PFAS in their serum of greater than the NASEM blood level of 2 ng/mL total PFAS. This is indicated by the range of measured values in the Australian population, and that 98.6%, 96.1% and 88.1% of the Australian population have detectable levels of PFOS, PFOA and PFHxS[2].

The panel recommended:

4.1 At present, there is no clinical benefit for an individual to have a blood test for PFAS.

4.2 The NASEM blood levels are not appropriate to guide clinical management.

4.3 Should a health care provider order a PFAS blood test for a patient, the health care provider should provide clear contextual information about the test and its limitations to the patient, to manage expectations and avoid misinterpretation. The health care provider should also offer these patients age-appropriate preventative health screening in line with current recommendations. Such recommendations should be made independent of the patient's PFAS level.

5. Interventions to reduce PFAS in blood

On reducing the body burden of PFAS, the panel concluded that:

- Phlebotomy and cholesterol lowering agents that are bile acid sequestrants (e.g. cholestyramine) may reduce serum PFAS levels. There is no evidence that indicates either of these methods will cause corresponding changes in biomarkers associated with PFAS (e.g. TSH, ALT, uric acid, creatinine) or provide any health benefits. The panel noted that these treatments can have associated harms. For example, cholestyramine is not well tolerated by many people and interacts with other medications. Phlebotomy increases the risk of anaemia.
- There are no approved medical treatments in Australia to remove PFAS from the body at present. The panel acknowledged that there may be rare circumstances where clinicians may consider interventions for specific individuals.

The panel recommended:

5.1 Interventions that reduce blood PFAS are of uncertain benefit and may cause harm.

5.2 Clinicians can support patients concerned with their serum PFAS levels by engaging in usual preventative health interventions, as many of the health conditions potentially associated with PFAS are common in the community and are associated with well-established risk factors.

6. How to communicate risk in the context of evolving evidence

The panel concluded that:

- There is genuine concern in parts of the community about exposure to PFAS and the potential health impacts.
- Factors that may increase community concern include the involuntary nature of exposure via drinking water, inconsistencies in information from different organisations, and some of the language used to describe PFAS, such as the term ‘forever chemicals’.
- Many of the communications to date have been overly technical and did not adequately address the information needs of community.
- Communication that supports well informed community discussion about the management of PFAS could be strengthened. Actions that have been taken to reduce PFAS exposure could be communicated more widely, for example Australian Government actions taken to phase out PFAS-containing firefighting foams.
- Continued transparency is important for integrity and to foster community trust.

The panel recommended:

6.1 Communication should be tailored to the diverse levels of concern in the community and should ensure continued transparency.

6.2 Communication methods may include small group engagement, trusted messengers, clinician support, clear public messaging and media engagement. Channels for community feedback should be identified.

6.3 NSW Health should review communication tools and content, to better support community and clinicians.

7. Future priorities for research

The panel concluded that:

- There is a range of research into PFAS and health effects including toxicological studies, animal studies, human biomonitoring programs and intervention studies currently underway. The panel specifically considered potential neurological effects and concluded that while the evidence was not convincing to support a probable link to neurological effects, this may warrant further study.
- Levels of PFAS exposure and the size of populations affected in Australia mean it is very challenging to conduct traditional epidemiological research that would reliably inform our understanding of the health effects of PFAS. In the right conditions, Australian research could be considered.

- Future research needs to overcome challenges related to confounders (such as age, sex and kidney function).
- Innovative use of quantitative measures of clinically significant outcomes may provide improved insights into potential causal associations.
- Interpretation of scientific evidence on PFAS can be difficult due to its technical nature, lack of consistent findings and the presence of significant limitations in many studies. Experts can support the community to interpret the evidence.

The panel recommended:

7.1 It is important to monitor, interpret and act on relevant evidence as it emerges globally.

7.2 NSW Health should assist clinicians and community leaders to support their communities to interpret the evidence about potential effects of PFAS exposures.

7.3 Representative population-based biomonitoring, such as the National Health Measures Survey[2], may be of value to continue to monitor changes in PFAS exposure in the Australian population.

Glossary

Term	Definition
Association	A statistical relationship between two factors, also known as a correlation. The presence of an association does not mean that one factor causes the other factor. For example, there is an association between smoking and alcoholism (that is, rates of smoking are higher in people with alcoholism), but one does not cause the other.
Absolute cancer risk	The chance that a person will develop a cancer of any type during a given time period.
Appraisal	An evidence-based judgement about the quality of something. Critical appraisal is a process that systematically examines the quality and reliability of research.
Bias	Occurs when there is problem with the way that a study is conducted, and this results in an inaccurate estimate of the association between a potential risk factor and an illness or outcome.
Biological plausibility	The extent to which an association between a risk factor and an outcome or illness is consistent with known biological mechanisms.
Biomarker	A biomarker is a measurable indicator of a biological state or condition, that is used to assess health status. Examples of biomarkers include cholesterol and blood glucose.
Causation	When there is sufficient evidence that a risk factor causes an outcome or illness. In epidemiology, several criteria should usually be met before causation would be accepted. These can include that the risk factor occurs before the outcome, there is biological plausibility, and there is a dose response relationship (i.e., that a higher level of exposure to the risk factor is linked to a higher probability of the outcome).
Confounding	Occurs when the apparent association between a potential risk factor and an illness or outcome is affected by the presence of a third factor. For example, children with bigger feet might have better reading scores than children with smaller feet – but this does not mean that big feet is the reason for greater reading ability. The relationship is confounded by age (the third factor), which is an underlying cause of both foot size and ability to read.
Dose-response relationship	Occurs when a higher level of exposure to a risk factor is linked to a higher likelihood of developing a specific outcome or illness. For example, a person who has smoked a packet of cigarettes daily for twenty years has a higher chance of developing lung cancer than a person who has smoked one cigarette daily for the same period.
Health-based screening	Tests which check whether a person has signs of specific health conditions before they become unwell.
Hazard	A hazard is something that has the potential to cause injury or illness. The risk posed by a hazard relies on how an individual might have contact with the hazard. If there is no significant exposure to the hazard, the hazard poses no risk.
Intermediate outcome	Something that occurs as part of the process leading to the final illness or other outcome. It is detected after exposure to a potential risk factor but is not the main illness or other outcome that is caused by the risk factor.

Limitation	Weakness in the way a study is conducted that may affect the accuracy of its findings.
Magnitude of effect/ effect size	A measure that shows how strong the association is between two factors (usually a risk factor and an outcome or illness).
Mechanism of action	The specific way a drug or substance produces an effect.
Phlebotomy	The process of taking blood from a person, typically for donating blood or obtaining a blood sample for testing.
Population-based	A study that uses the general population, rather than a specific group, from which to draw study participants.
Population sample	A sub-group from a population of interest, usually selected to represent the whole population.
Risk factor	Any factor that represents a greater risk of a health disorder or other unwanted condition or event. Exposure to a hazard can be a risk factor. Common examples of risk factors include age, smoking or family history which can be risk factors for specific diseases.
Safety factors	When calculating threshold levels, safety factors are used to account for adequacy of the study, inter-species extrapolation, inter-individual variability in humans, adequacy of the overall database, nature and extent of toxicity, public health regulatory concern and scientific uncertainty. They ensure threshold levels are conservative and protective of health.
Summed PFAS	A number that is calculated by adding together the level of multiple types of PFAS.
Threshold exposure level	The highest acceptable concentration level of a chemical in the environment, for example water and food below which there is not expected to be any harm.
Types of studies	This document refers to several different types of scientific studies. In terms of studies of PFAS: • An **epidemiological study** is a study of groups of people (e.g. the general population, or a population within a defined area) and measures some aspect of their exposure to PFAS and/or health. • A **biomonitoring study** includes people from a population and measures the level of PFAS in their blood. • An **intervention study** measures the impact of a specific treatment on health outcomes. • An **animal study** involves administering PFAS to animals within a laboratory setting, and measures whether and what health outcomes they develop. • A **human study** refers to any scientific study that involves humans as subjects. • A **toxicological study** looks at the harmful effects of PFAS chemicals. Toxicological studies can include studies in humans, animals or cells.

References

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