Select Committee on PFAS Contamination in Waterways and Drinking Water Supplies Throughout New South Wales
Inquiry Into PFAS Contamination in Waterways and Drinking Water Supplies Throughout New South Wales

ANSWERS TO WRITTEN QUESTIONS ON NOTICE
Commonwealth Scientific and Industrial Research Organisation (CSIRO)
5 February 2025

Question

1. What new PFAS removal technologies is CSIRO currently testing?

Answer

CSIRO is developing and testing PFAS destructive technologies such as incineration, pyrolysis, thermal desorption, electrochemical oxidation, and microbial biodegradation [e.g., 1-3]. A combination of non-destructive PFAS removal with subsequent PFAS destruction in the concentrated waste stream is often the most sustainable and cost-efficient approach to dealing with PFAS.[4] Non-destructive technologies being developed and tested by CSIRO include adsorbent/filter materials, sealants, and phyto- and entomo-remediation [e.g., 5-9]. The removal of PFAS from media (e.g., drinking water) onto adsorbents or resins will create concentrated waste streams with PFAS still intact which will need to be remediated by destructive technologies (e.g., incineration) to avoid creating a PFAS legacy for future generations of Australians (e.g., disposal in landfills).

Question

2. Is there a realistic, cost-effective pathway to eliminate PFAS from NSW drinking water?

Answer

Before this question can be answered, it is necessary to characterise the composition of PFAS in NSW drinking water in more detail (accounting for variability over time and space). If only the three currently regulated compounds, PFOA, PFOS, and PFHxS, are needed to be removed, then standard treatment processes such as filtration, granular activated carbon or ion exchange are typically (cost)-effective (dependent on treatment volume and matrix to be treated).[10] However, if for instance ultrashort-chain PFAS such as trifluoroacetate (TFA) are present in drinking waters and the goal is to remove total PFAS and not just the regulated compounds, then more costly treatment processes will likely be required, such as reverse osmosis (also used for seawater desalination).[11]

We also note that understanding costs will require more than direct financial considerations; it will require consideration of social, economic, cultural and ecosystem ‘costs’ and advanced analytical tools to understand costs (e.g. life-cycle analyses, techno-economic analyses) and modelling. CSIRO has the integrated capability to provide science outcomes to better understand all costs of PFAS removal from drinking water and other systems in Australia.

Question

3. Should Australia adopt stricter PFAS limits in water, similar to the US EPA's recent regulations?

Answer

CSIRO does not have a role with establishing or operationalising federal or state regulatory frameworks, apart from assisting with science outcomes that can underpin their establishment and revision. As Australia's national research agency, it is CSIRO's role to partner across the breadth of regulatory agencies, industry and community groups to understand and fill knowledge gaps and advance technologies that would assist with defining, prioritising and controlling PFAS risks.

As highlighted in CSIRO's inquiry submission, we are likely underestimating the future impacts of PFAS in Australia, as current monitoring, assessment and management programs focus on the three main regulated chemicals – PFOS, PFOA, and PFHxS [e.g., 12,13]. PFAS in the environment can consist of many thousands of chemicals of which we have little understanding of impacts in the environment (e.g., ecotoxicity). Recent advancements in ultra high-resolution non-targeted PFAS analysis now allow for the detection of a larger number of PFAS (and other contaminants of concern) in complex mixtures occurring in media [e.g.,14-16]. This ultra high-resolution PFAS detection capability can be integrated with advancements in hazard/risk-based prediction tools (e.g., persistence, bioaccumulation and toxicity potential) to assess human and environmental risks from an increasing number of chemicals being developed, produced, used and imported into Australia.

Question

4. What are the long-term risks of inaction on PFAS contamination in NSW?

Answer

As highlighted in CSIRO's inquiry submission, the risk of inaction on PFAS contamination in NSW and Australia would include:

<u>Human Health</u>

While CSIRO does not have a research focus on the risks to human health, we note there is increasing evidence that long-term exposure to some PFAS can be harmful to human health[17-19]. While this evidence is still developing, there is increasing global concern about the persistence and mobility of these chemicals in the environment. There is also increasing international concern about a much wider range of PFAS than those subjected to current regulations in Australia.

<u>Environmental</u>

There are significant knowledge gaps in PFAS distribution and scale (waters, soils, sediments and biota) across Australian geographic and climate conditions, and effects on biota (especially Australian native and/or culturally relevant species) exposed to PFAS throughout their lifetime (chronic effects). The impacts on aquatic ecosystems, and terrestrial and semi-terrestrial wildlife that rely on them are further compounded by the bioaccumulation of PFAS throughout the food web. Research by CSIRO on wildlife, employing advanced ecotoxicology through systems biology and multi-omics-based approaches, indicates that chronic exposure to PFAS mixtures may be affecting Australian reptiles[20-

[24]. Specifically, multigenerational effects on freshwater turtles have been reported suggesting population effects in areas with high PFAS concentrations.[24]

Social

There has been little research undertaken in Australia on the direct or indirect impacts/risks and cost of managing PFAS on communities and indigenous peoples. Residents near contaminated sites may face higher costs associated with managing PFAS contaminated water sources (e.g., having to pay for alternative water supplies, switching from bore water to town water, water treatment including filtration). Properties and houses near to PFAS-impacted areas may be subject to depreciation and/or face difficulty in selling and renting.[25] Producers in PFAS-affected areas can suffer reputational harm and income loss from being unable to sell or export crops and/or livestock. PFAS contaminated areas such as waterways maybe be closed or restricted from recreational activities such as fishing.[26] First Nations people may be feeling a disconnection to Country, uncertainty around long-term health outcomes, or access to culturally significant sites, waters, and foods.[25]

Economic

The economic costs of inaction on PFAS could be substantial, including potentially significant costs related to healthcare from PFAS exposure, drinking water treatment, soil, sediment and waste remediation, and potential legal labilities (e.g., from communities). One study estimated that the global societal cost of using PFAS, including health care costs, totals about $26tn annually.[27] Remediation costs for PFAS in media are high, driven by the low guideline and regulatory levels. The estimated costs for cleaning up of approximately 1 kg of perfluoroalkyl acids (i.e., fully fluorinated PFAS that include the regulated PFOA, PFOS, and PFHxS) from water, biosolids, and landfill leachate are on the order of double-digit million dollars per year.[28] The cost to public water systems in the United States to meet new PFAS drinking water regulations has been estimated to cost in the billions.[29] In the United Kingdom, remediation costs for between 2,900 and 10,200 high-risk sites were estimated to be between $61bn and $237bn.[30]

Question

5. ***Your submission calls for the establishment of Australian PFAS anthropogenic background levels in media (i.e., soils, waters, atmosphere and biota) across geographic and climatic conditions to support site regional risk assessments and clean-up levels. Are there any roadblocks to this sort of body being established?***

Answer

PFAS background (ambient) concentrations in environmental media (e.g., atmosphere, rainfall, soils, waters, air and biota) are needed to facilitate the setting of site-specific levels for remediation/cleanup activities and the assessment of risks to the environment, wildlife, and human health. The main roadblocks to a PFAS background in Australia are the design and establishment of a systematic monitoring program (accounting for variability over time and space) across all jurisdictions (local, State and Federal) and adequate funding for the collection, analysis and reporting in a range of environmental media across land use options, regions, and seasons. CSIRO's PFAS monitoring and characterisation capability is currently being applied to projects to determine baseline and ambient background concentration in media across Australia. We note that a national PFAS monitoring system could better determine the scope and scale of the PFAS issue nationally, and provide useful insights into the risks, but such a system would not be a solution (i.e. it would not involve the treatment or mitigation of PFAS).

Question

6. Practically, how do you think a body like this could be established? Would it be a part of the CSIRO?

Answer

PFAS contamination is a critical national issue that, if not managed correctly, will impact current and future generations of Australians. A national body to coordinate and integrate agencies to identify and address priority PFAS concerns for Australia would be valuable. An integrated national PFAS body could work closely with communities, contaminated sites, sectors and researchers to deliver the critical science, resources and funding required to support Australian industries (e.g., manufacturing, agriculture, energy and mining) and the protection of human and environmental health. As Australia's national science agency, CSIRO is well positioned and has the capability to support the science prioritisation framework and process to ensure common sense, cost-efficient and timely data and solutions are delivered for meaningful insights and actions, with nation-wide benefit.

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