The PFAS problem

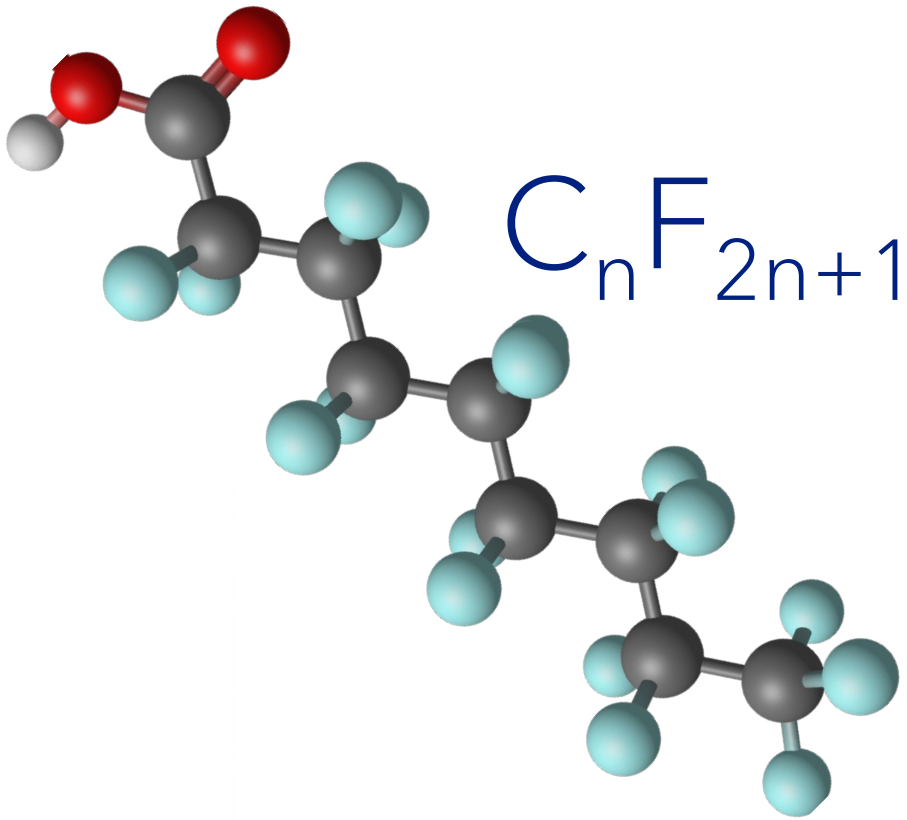
Dr Karl Bowles & Brad Dalrymple

Australian Water School Webinar, 25 June 2025

What are PFAS

Per & poly-fluoroalkyl substances (PFAS)

- Manufactured ‘forever chemicals’
- Produced since ~1930’s
- Used in various products
  - carpets, clothes, food packaging & paper, firefighting foams, pesticides & stain repellents
  - make products non-stick, oil- & water-repellent, and fire, weather- and stain-resistant



C_nF_{2n+1}

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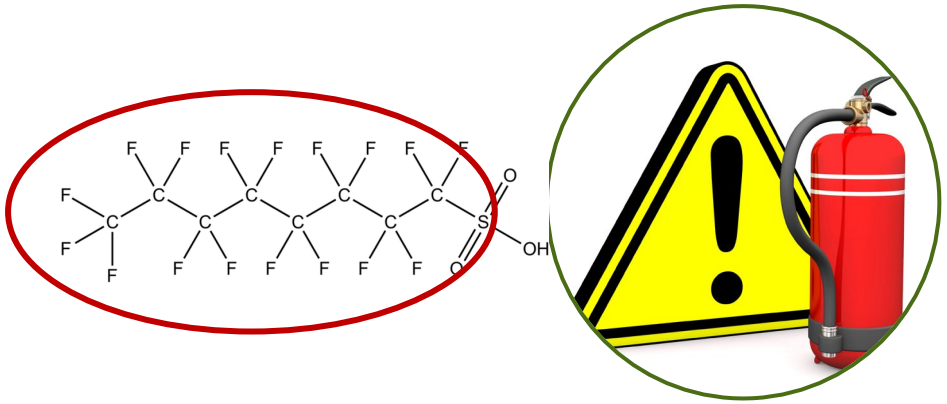
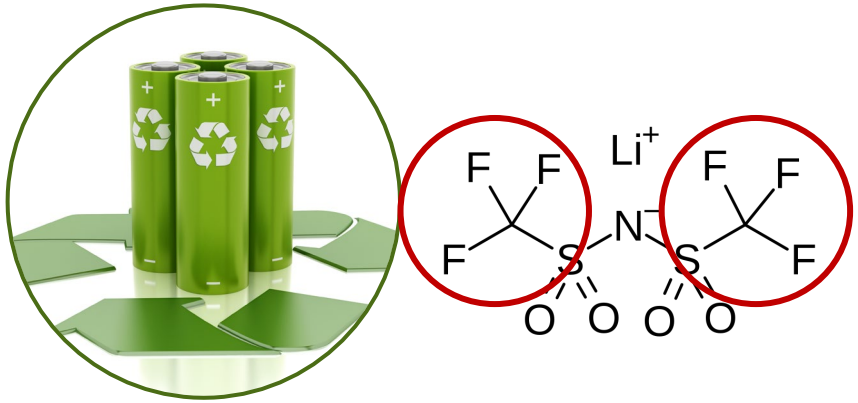
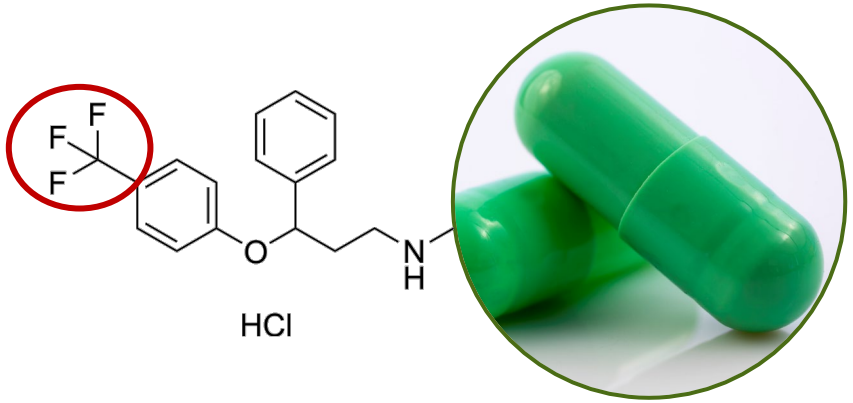
‘Other’ PFAS in the water sector?

Vast variety of PFAS

- Different uses
- Different structures
- Different environmental behaviour
- Different toxicities
- Different treatment requirements



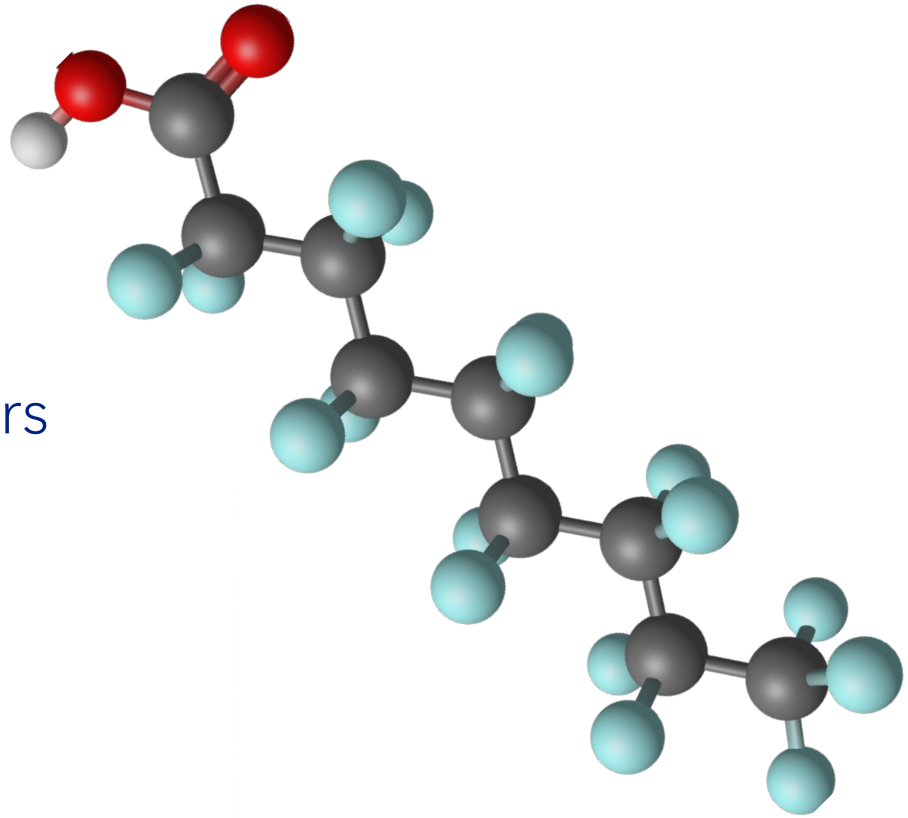





What’s all the
fuss about ?

What's all the fuss about ?

- Toxic
- Bio-accumulative
- Everywhere
- Links to negative health impacts
- High priority for environmental regulators



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In the media (& courts)

WaterNSW disconnects Medlow Dam in the Blue Mountains as investigations continue into presence of 'forever chemicals' in water

By Jean Kennedy | Water Pollution

Wed 28 Aug

PFAS 'forever chemicals' found in water filtration plants and platypus livers in NSW

By Xanthe Gregory | Water Pollution

Tue 20 Aug

Scientists from Western Sydney University found perfluorooctane sulfonate (PFOS) in the livers of eight deceased platypuses.

ABC NEWS

$212m PFAS payout for property value loss and distress, but residents' contamination fears linger

ABC Katherine / By Jon Daly

ABC NEWS

Leaseholders impacted by toxic PFAS foam n out in $132.7 million compensation payout

By Xanthe Gregory

Top US chemical firms to pay $1.2bn to settle water contamination lawsuits

Dupont, Chemours and Corteva agree deal and 3M also reportedly considering $10bn settlement to avoid trial due to start on Monday

3M pays $10.3bn to settle water pollution suit over 'forever chemicals'

Settlement will provide funds to US municipalities over 13 years to test for and treat PFAS contamination in public water systems

3M did not admit liability when reaching the settlement. Photograph: Nicholas Pfosi/Reuters

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PFAS

Alarming levels of PFAS in Norwegian Arctic ice pose new risk to wildlife

Oxford University-led study detects 26 types of PFAS compounds in ice around Svalbard, threatening downstream ecosystems

the japan times

Japan slowly wakes up to health risks of PFAS 'forever chemicals'

nature

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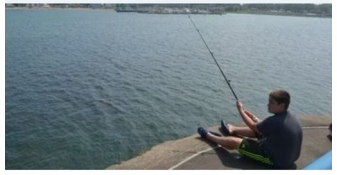
nature > news > article

NEWS | 17 March 2023

How the US will remove 'forever chemicals' from its drinking water

The EPA has proposed a strict PFAS limit, but it will take money and innovative technologies to implement the plan.

Environmental Health News



Jan 13, 2023

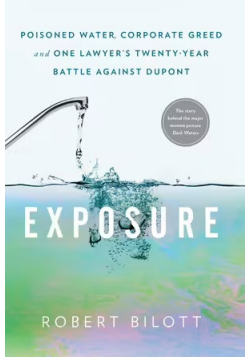
Just one meal of caught fish per year is a significant dose of PFAS

"These fish are incredibly contaminated."

ABC NEWS

Defence says 30 kilograms of toxic PFAS is still flowing into creeks in Darwin each year

By Jane Gibson



PHYS.ORG

October 26, 2022

Earth \ Environment

'Forever chemicals' persist through wastewater treatment, may enter crops

by Pennsylvania State University

Would you like to receive trending story notifications on your smartphone?

ABC NEWS

Launceston Airport sues Airservices Australia over PFAS chemical clean-up

By Ellen Coulter

The use of PFAS chemicals in firefighting has been commonplace around Australia. (Supplied: CRC CARE)

CBS NEWS

HEALTHWATCH ›

Raincoats, undies, school uniforms: Are your clothes dripping in "forever chemicals"?

BY HANNAH NORMAN

MARCH 30, 2023 / 5:00 AM / KAISER HEALTH NEWS

ABC NEWS

Highest reported PFAS levels in world found in rare Burrunan dolphins off Victorian coast

By Natasha Schapova | By William Howard | ABC Gippsland | Nature

Tue 21 Nov 2023

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PFAS in our rain

BBC

Pollution: 'Forever chemicals' in rainwater exceed safe levels

2 August 2022

Share Save

Matt McGrath
Environment correspondent

PFAS have been found in rain in Tibet

New research shows that rainwater in most locations on Earth contains levels of chemicals that "greatly exceed" safety levels.

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Environmental Science & Technology

pubs.acs.org/est

Perspective

Outside the Safe Operating Space of a New Planetary Boundary for Per- and Polyfluoroalkyl Substances (PFAS)

Ian T. Cousins,* Jana H. Johansson, Matthew E. Salter, Bo Sha, and Martin Scheringer

Cite This: *Environ. Sci. Technol.* 2022, 56, 11172–11179

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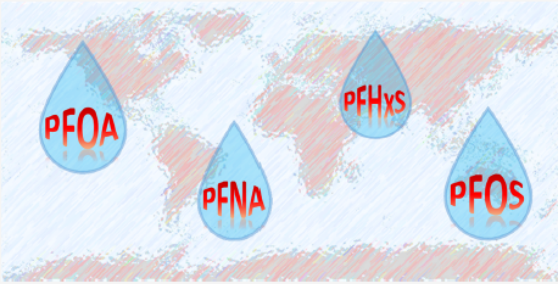
ABSTRACT: It is hypothesized that environmental contamination by per- and polyfluoroalkyl substances (PFAS) defines a separate planetary boundary and that this boundary has been exceeded. This hypothesis is tested by comparing the levels of four selected perfluoroalkyl acids (PFAAs) (i.e., perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorohexanesulfonic acid (PFHxS), and perfluorononanoic acid (PFNA)) in various global environmental media (i.e., rainwater, soils, and surface waters) with recently proposed guideline levels. On the basis of the four PFAAs considered, it is concluded that (1) levels of PFOA and PFOS in rainwater often greatly exceed US Environmental Protection Agency (EPA) Lifetime Drinking



PFAS in surface & groundwaters

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9 April 2024

PFAS 'forever chemicals' above drinking water guidelines in global source water

nature geoscience

Article https://doi.org/10.1038/s41561-024-01402-8

Underestimated burden of per- and polyfluoroalkyl substances in global surface waters and groundwaters

Received: 27 September 2023

Accepted: 15 February 2024

Diana Ackerman Grunfeld[1], Daniel Gilbert[1], Jennifer Hou[1], Adele M. Jones[1], Matthew J. Lee[1], Tohren C. G. Kibbey[2] & Denis M. O'Carroll[1]

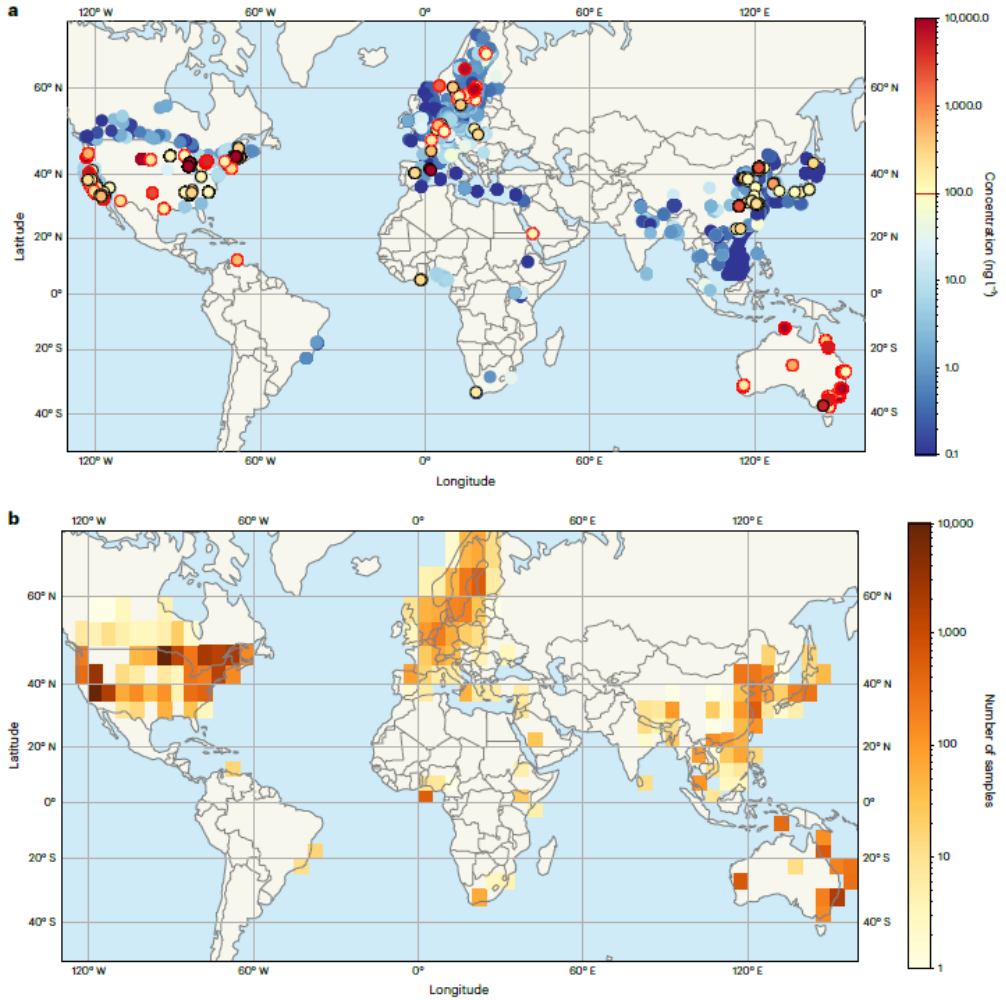

Fig. 1 | Global map of PFAS concentration in water. **a**, Sum of concentration of 20 PFAS subject to EU guidance in surface water, groundwater and drinking water samples. Those above the EU drinking water limit of 100 ng l^{-1} (marked red on scale bar) are circled in red (for known contamination sources (for example, AFFF or non-AFFF)) or black (unknown sources). **b**, Number of PFAS samples available on a 5° longitude/latitude grid worldwide.

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"research efforts tend to concentrate on locations where PFAS presence is likely"

Is my water safe to drink ?

NHMRC BUILDING A HEALTHY AUSTRALIA

- *"PFAS levels measured in Australia by water utilities have been generally below (or well below) the current Australian Drinking Water Guidelines".*

https://www.nhmrc.gov.au/health-advice/environmental-health/water/PFAS-review/questions-and-answers

ABC NEWS

WaterNSW disconnects Medlow Dam in the Blue Mountains as investigations continue into presence of 'forever chemicals' in water

By Jean Kennedy | Water Pollution

Wed 28 Aug

Medlow Dam has been shut off. *(Supplied: WaterNSW)*

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PFAS in beer

Image source: Adobe Stock

The Guardian Aus

Pfas detected in US beers in new study, raising safety concerns

Researchers point to contaminated water after 'forever chemicals' found in all but one of 23 sampled beers

What are Pfas? Everything you need to know

In wine, there is truth. In beer, there is freedom and also apparently forever chemicals, according to new research. Photograph: Paul Ellis/AFP/Getty Images

Environ Sci Technol. 2025 May 6;59(17):8368-8379. doi: 10.1021/acs.est.4c11265. Epub 2025 Apr 24.

Hold My Beer: The Linkage between Municipal Water and Brewing Location on PFAS in Popular Beverages

Jennifer Hoponick Redmon [1], Nicole M DeLuca [1], Evan Thorp [1], Chamindu Liyanapatirana [1], Laura Allen [1], Andrew J Kondash [1]

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PFAS in our dolphins

THE CONVERSATION

Science of the Total Environment 908 (2024) 168438

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Hepatic concentrations of *per*- and polyfluoroalkyl substances (PFAS) in dolphins from south-east Australia: Highest reported globally

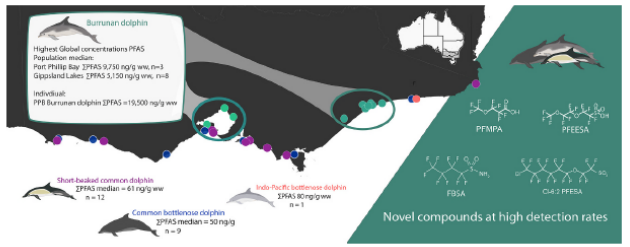
Chantel S. Foord [a,b,*], Drew Szabo [c,d], Kate Robb [b], Bradley O. Clarke [c], Dayanthi Nugegoda [a]

[a] Royal Melbourne Institute of Technology, Bundoora, Australia
[b] Marine Mammal Foundation, Mentone, VIC
[c] Australian Laboratory for Emerging Contaminants, School of Chemistry, University of Melbourne, Victoria 3010, Australia
[d] Department of Materials and Environmental Chemistry, Stockholm University, Svante Arrhenius Väg 16C, SE-106 91 Stockholm, Sweden

HIGHLIGHTS

- 25 PFASs quantifiable in stranded dolphin hepatic tissue across Victoria, Australia
- Highest reported dolphin hepatic ∑PFOS (maximum; 18,700 ng/g ww)
- Inshore dolphins have higher PFAS concentrations than offshore dolphins.
- PFOS values exceed thresholds for health impacts by >10×.
- Novel compounds PFMPA, PFECHS and 6:2 Cl-PFESA found at high detection rates.

GRAPHICAL ABSTRACT



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The concentrations of PFOS exceed published tentative critical concentrations (677–775 ng/g) in 42% of all dolphins and 90% of the critically endangered Burrunan dolphin.

PFAS in our platypus

ABC NEWS

PFAS 'forever chemicals' found in water filtration plants and platypus livers in NSW

By Xanthe Gregory | Water Pollution

Tue 20 Aug

Scientists from Western Sydney University found perfluorooctane sulfonate (PFOS) in the livers of eight deceased platypuses. *(Supplied: Western Sydney University)*

Environmental Science and Pollution Research (2024) 31:51037–51042
https://doi.org/10.1007/s11356-024-34704-w

SHORT RESEARCH AND DISCUSSION ARTICLE

Check for updates

First report of accumulation of perfluorooctane sulfonate (PFOS) in platypuses *(Ornithorhynchus anatinus)* in New South Wales, Australia

Katherine G. Warwick[1] · Ian A. Wright[1] · Jessica Whinfield[2,3] · Jason K. Reynolds[1] · Michelle M. Ryan[1]

Received: 15 April 2024 / Accepted: 9 August 2024 / Published online: 16 August 2024

Abstract
The platypus (*Ornithorhynchus anatinus*) is a semi-aquatic monotreme that occupies a high trophic position in the freshwater ecosystems of eastern mainland Australia and Tasmania. Platypuses are continuously exposed to anthropogenic contaminants including perfluorooctane sulfonate (PFOS). This study examined PFOS concentrations in the livers of deceased platypuses (eight wild; one captive) that were opportunistically collected across NSW over a two- and a half-year period. There was a large variation in PFOS concentrations, ranging from < 1 µg/kg to 1200 µg/kg. This study presents the first report of PFOS contamination in platypuses, revealing their PFOS levels are broadly similar to those found in river otters (*Lutra canadensis*) and lower than those in American mink (*Mustela* vison), both which occupy similar ecological niches in freshwater systems. This study raises concerns about the impact of PFOS on platypus health.

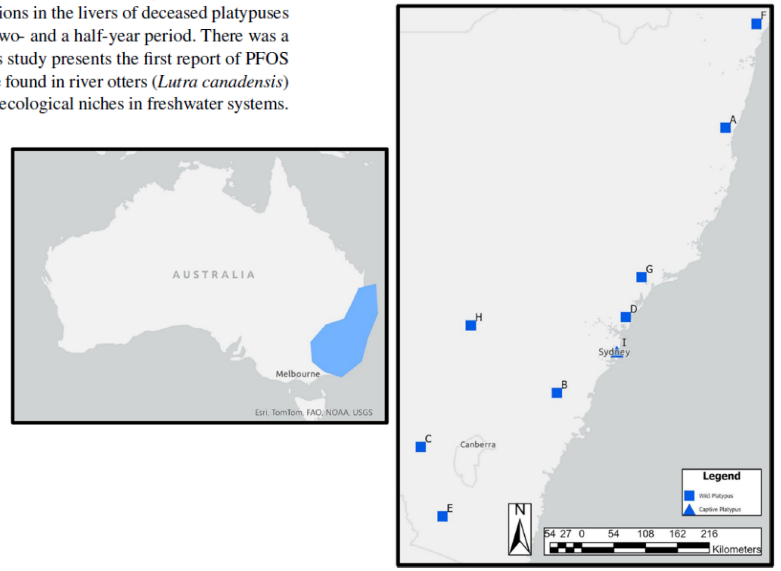

Fig.1 Location of platypus carcasses collected across New South Wales, Australia

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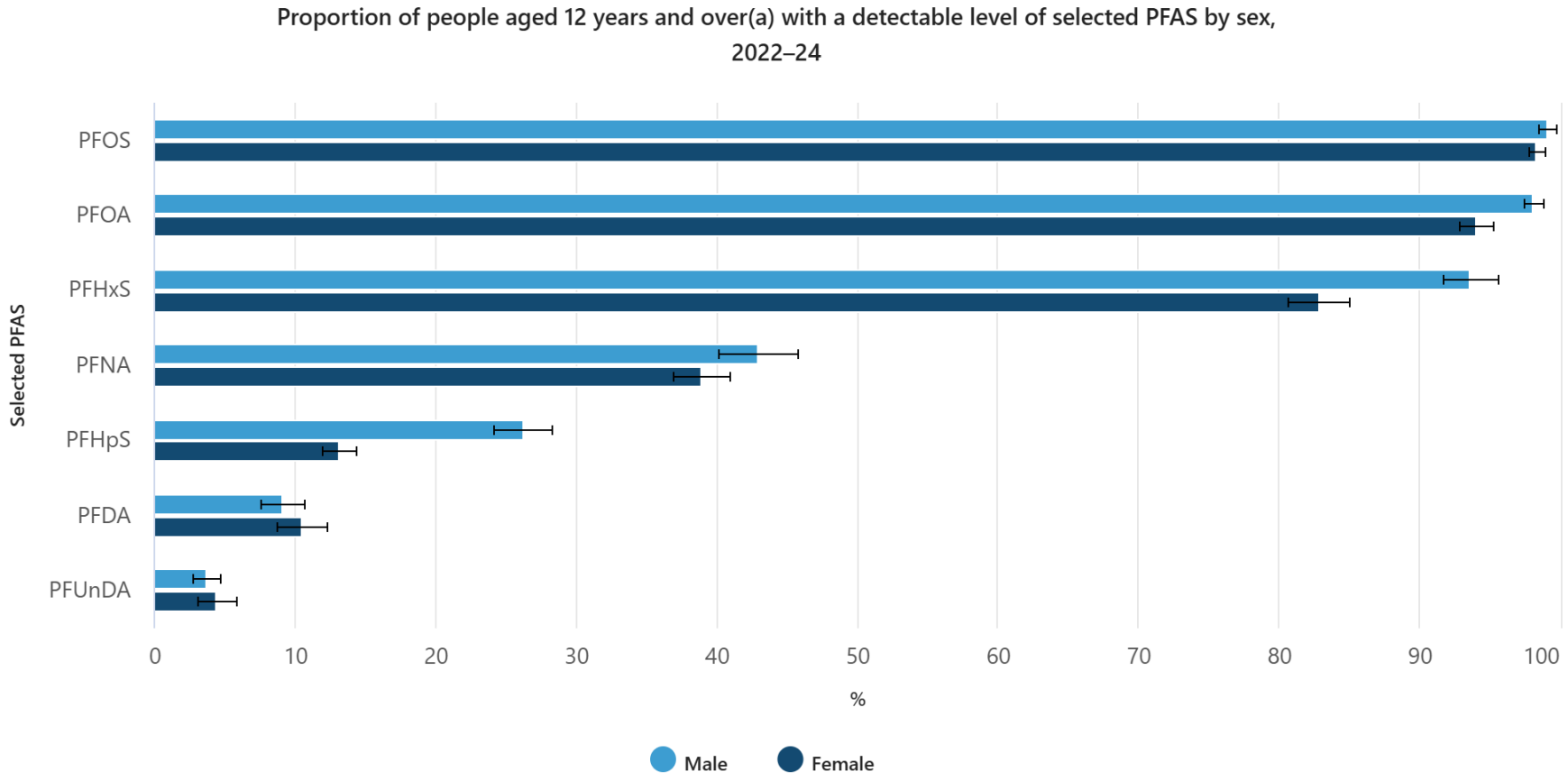
PFAS is in our blood



a. Weighted results for persons where a blood sample was collected.

Source: Australian Bureau of Statistics, Per- and polyfluoroalkyl substances 27/05/2025

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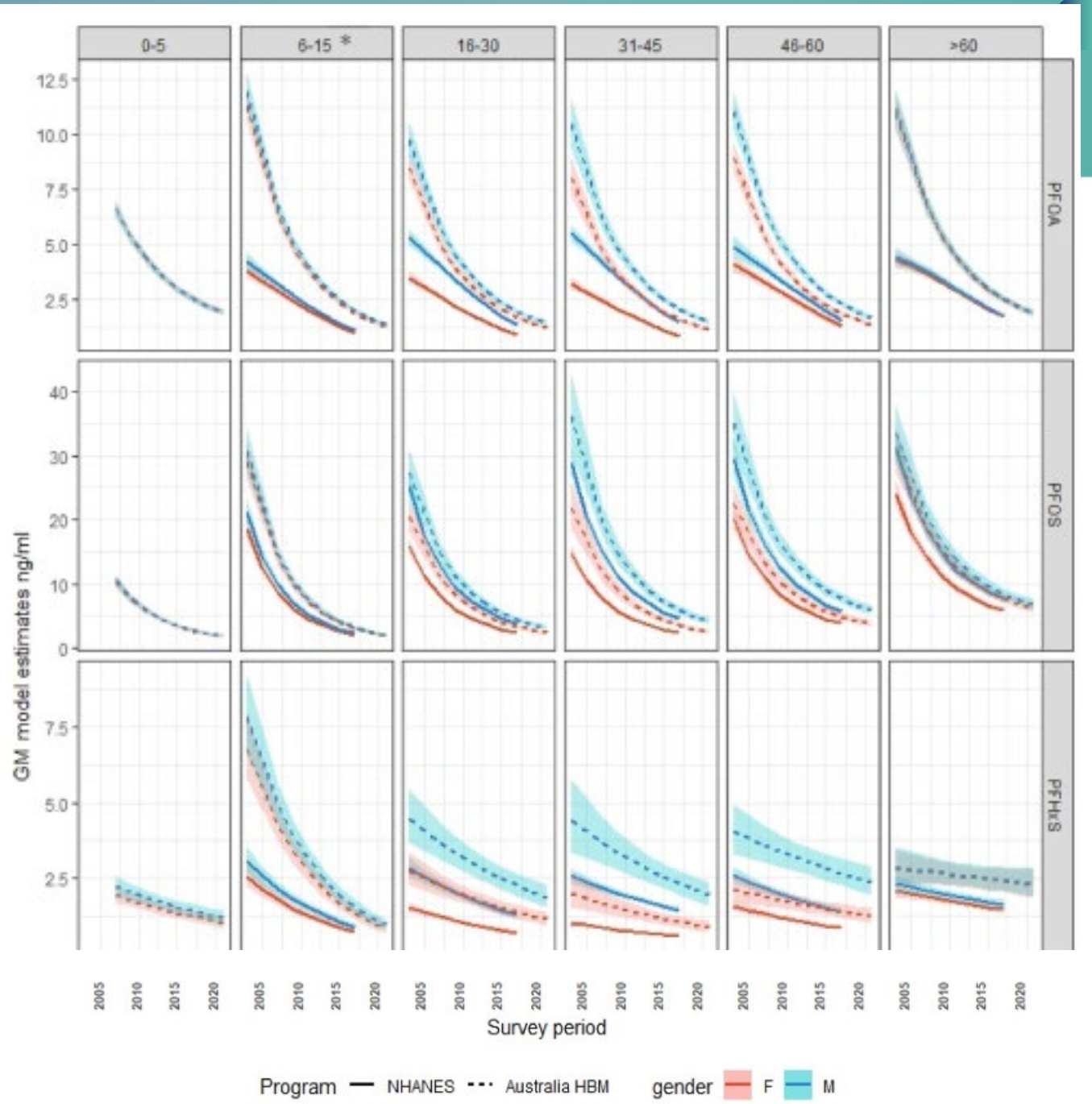
More on (or less in) blood

Taucare et al. 2024
https://doi.org/10.1016/j.envres.2024.119777



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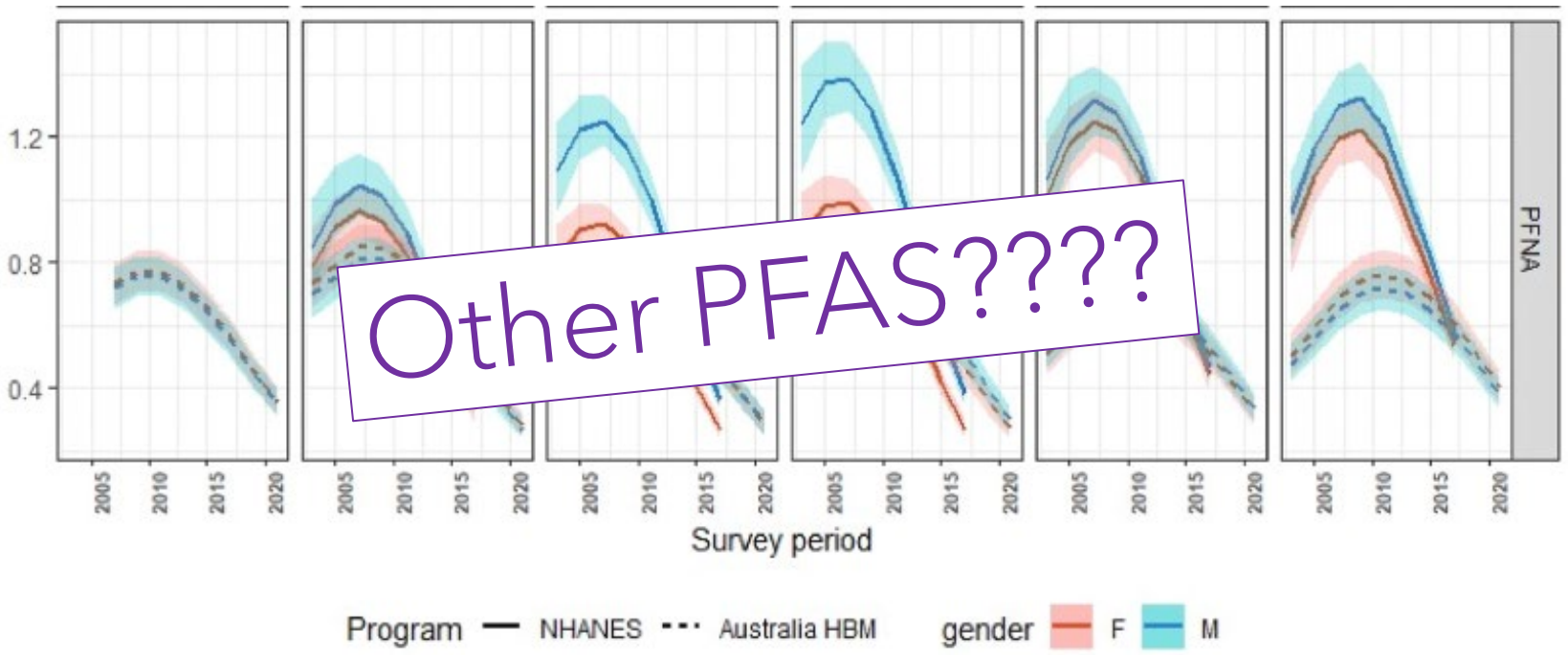
More on (or less in) blood

Taucare et al. 2024
https://doi.org/10.1016/j.envres.2024.119777



Other PFAS????

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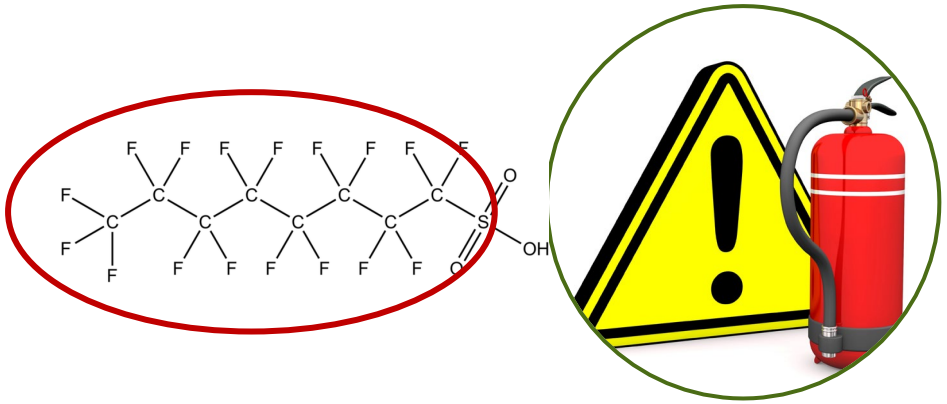
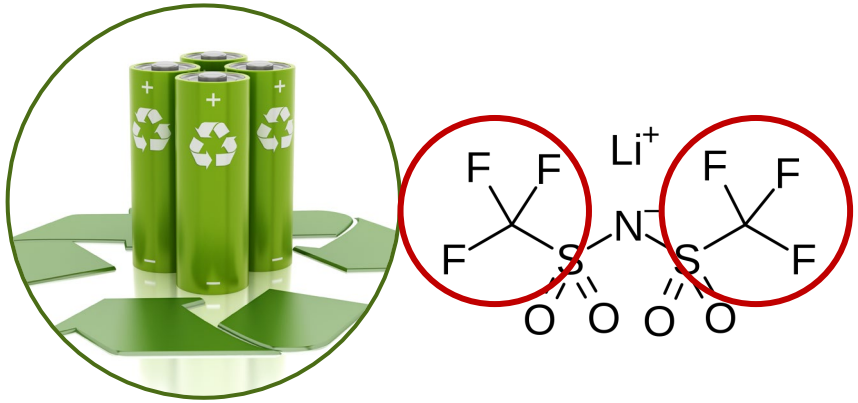
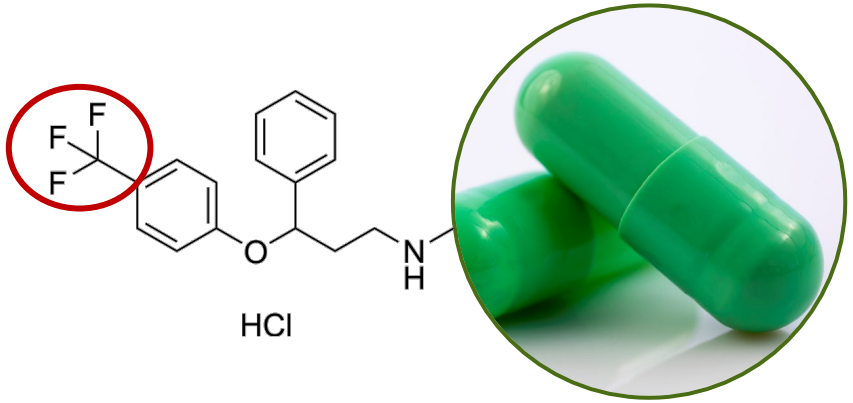
Remember this slide?

Vast variety of PFAS

- Different uses
- Different structures
- Different environmental behaviour
- Different toxicities
- Different treatment requirements







PFAS & human health

Environmental Toxicology and Chemistry—Volume 40, Number 3—pp. 606–630, 2021
Received: 20 July 2020 | Revised: 29 August 2020 | Accepted: 20 September 2020

Critical Review

Per- and Polyfluoroalkyl Substance Toxicity and Human Health Review: Current State of Knowledge and Strategies for Informing Future Research

Suzanne E. Fenton,[a] Alan Ducatman,[b] Alan Boobis,[c] Jamie C. DeWitt,[d] Christopher Lau,[e] Carla Ng,[f] James S. Smith,[g] and Stephen M. Roberts[h,*]

[a]National Toxicology Program Laboratory, National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina, USA
[b]West Virginia University School of Public Health, Morgantown, West Virginia, USA
[c]Imperial College London, London, United Kingdom
[d]Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University, Greenville, North Carolina, USA
[e]Public Health and Integrated Toxicology Division, Center for Public Health and Environmental Assessment, Office of Research and Development, US Environmental Protection Agency, Research Triangle Park, North Carolina, USA
[f]Departments of Civil and Environmental Engineering and Environmental and Occupational Health, University of Pittsburgh, Pittsburgh, Pennsylvania, USA
[g]Navy and Marine Corps Public Health Center, Portsmouth, Virginia, USA
[h]Center for Environmental & Human Toxicology, University of Florida, Gainesville, Florida, USA

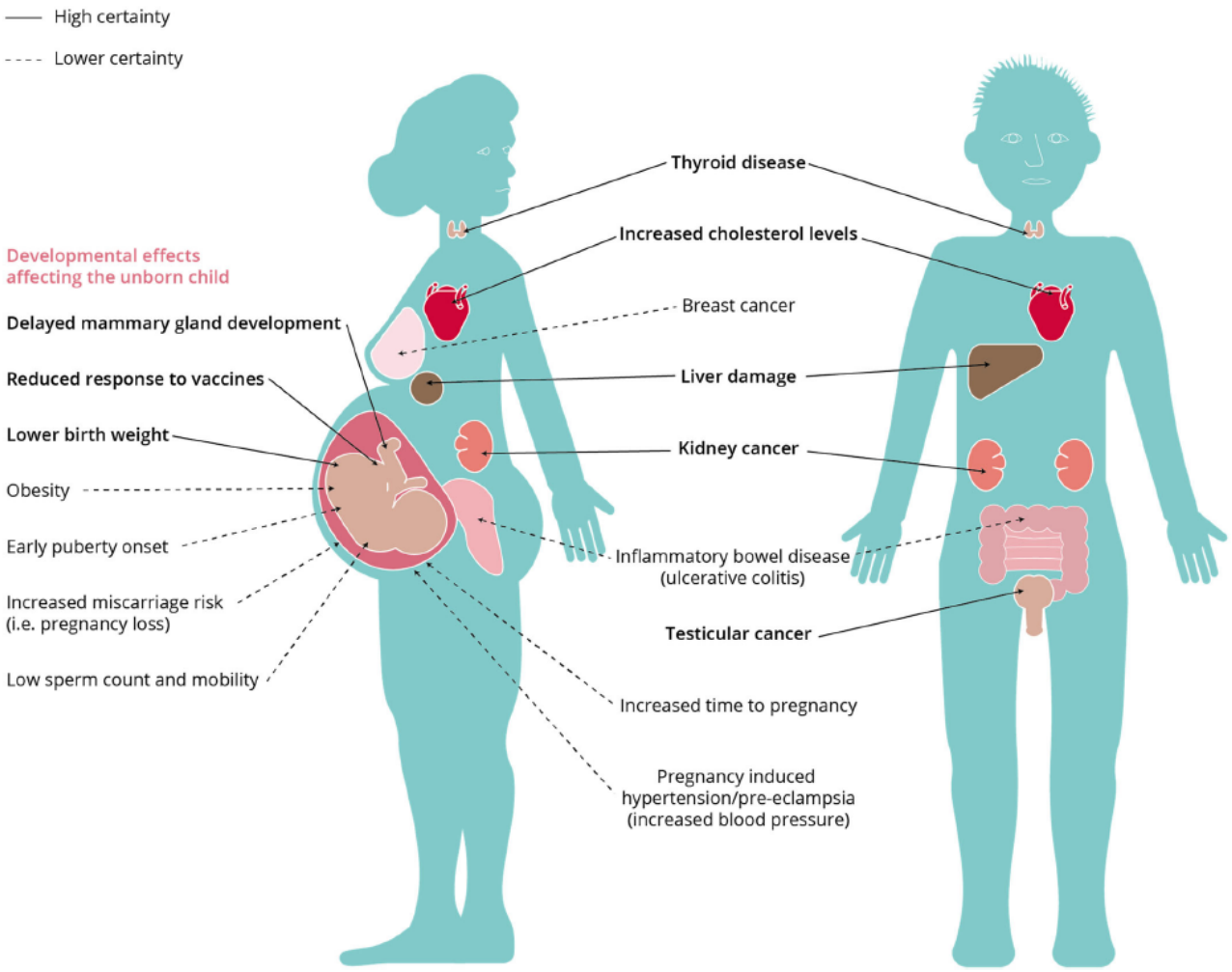


FIGURE 1: Effects of per- and polyfluoroalkyl substances on human health. Used with permission from European Environment Agency (2019). Original sources for this figure: National Toxicology Program (2016), C8 Science Panel (2012), IARC Working Group on the Evaluation of Carcinogenic Risks to Humans (2017), Barry et al. (2013), Fenton et al. (2009), and White et al. (2011b).

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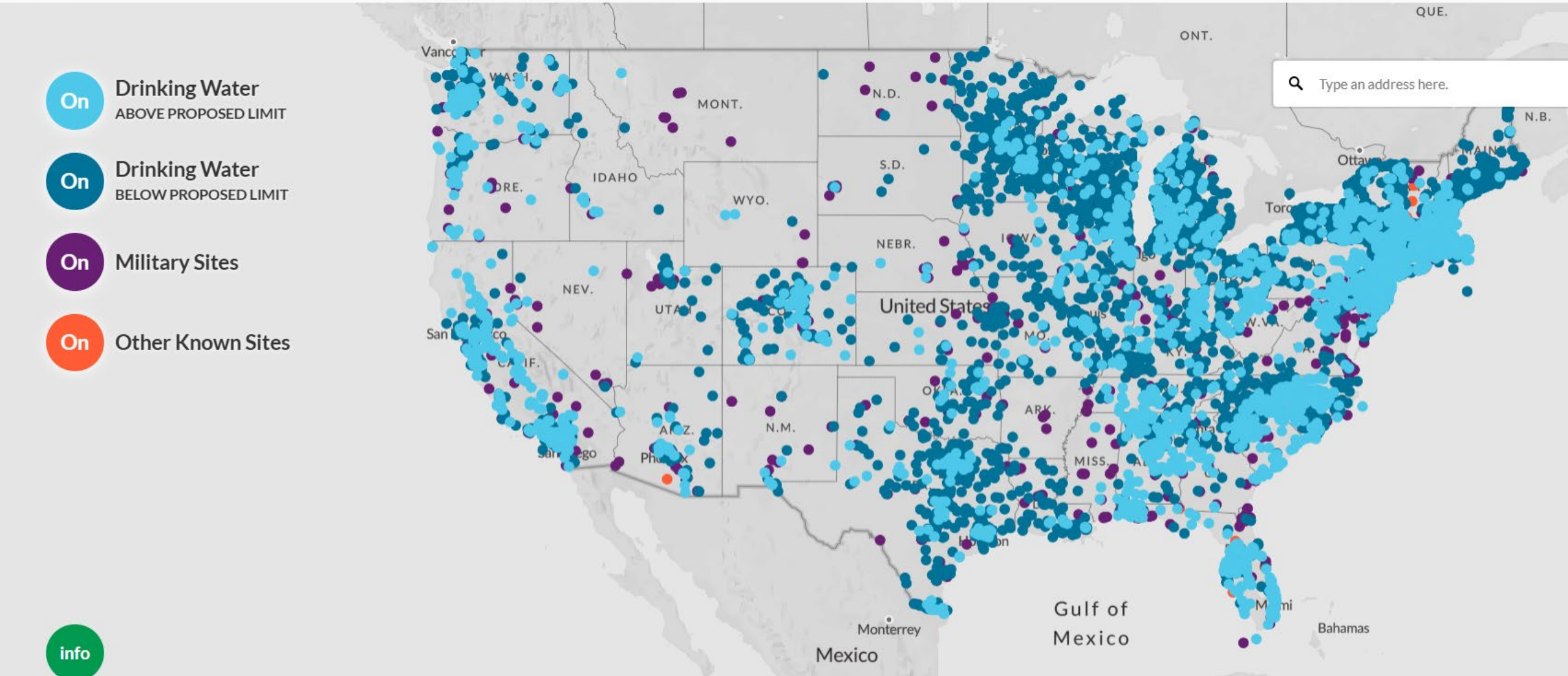
https://www.ewg.org/interactive-maps/pfas_contamination/map

PFAS contamination in the U.S. (June 10, 2025)



Australian Government
Defence

PFAS INVESTIGATION AND MANAGEMENT PROGRAM

SERVICE
COURAGE
RESPECT
INTEGRITY
EXCELLENCE

PFAS INVESTIGATION AND MANAGEMENT PROGRAM SNAPSHOT – May 2025

REMEDIATION ACTIVITIES

Remediation works targeting contaminated water, soil and other materials are underway or completed at Swartz Barracks, HMAS *Cerberus*, Jervis Bay Range Facility and RAAF Bases Pearce, Edinburgh, Williamtown, East Sale, Tindal, Richmond, Wagga, Darwin and Townsville.

Remediation works are scheduled to commence in the coming months at HMAS *Albatross*, Blamey Barracks, Lavarack Barracks, Bandiana Military Area and RAAF Base Amberley.

ONGOING MONITORING

Defence regularly monitors for PFAS on and around impacted sites. Monitoring results help Defence understand how PFAS is moving in the environment. This information also guides Defence's remediation and management actions.

DEFENCE ESTATE

Since 2004, Defence has reduced the use of legacy firefighting foams containing PFAS across the Defence Estate. Defence has transitioned its fire vehicles and handheld and portable extinguishers to a PFAS-free foam. To prevent future contamination, Defence is undertaking a program of works to remove foams containing PFAS from the estate.

KEY STATISTICS

Properties connected to town water **378**

161 rainwater tanks provided to **118** properties

Community engagement events conducted **185**

869 properties have water assistance extended from 6 to 8 years

REMEDIATION

Treated or removed over **180,000** tonnes of contaminated soil

Operate and maintain **7** water treatment plants

Treated over **12.2** billion litres of water

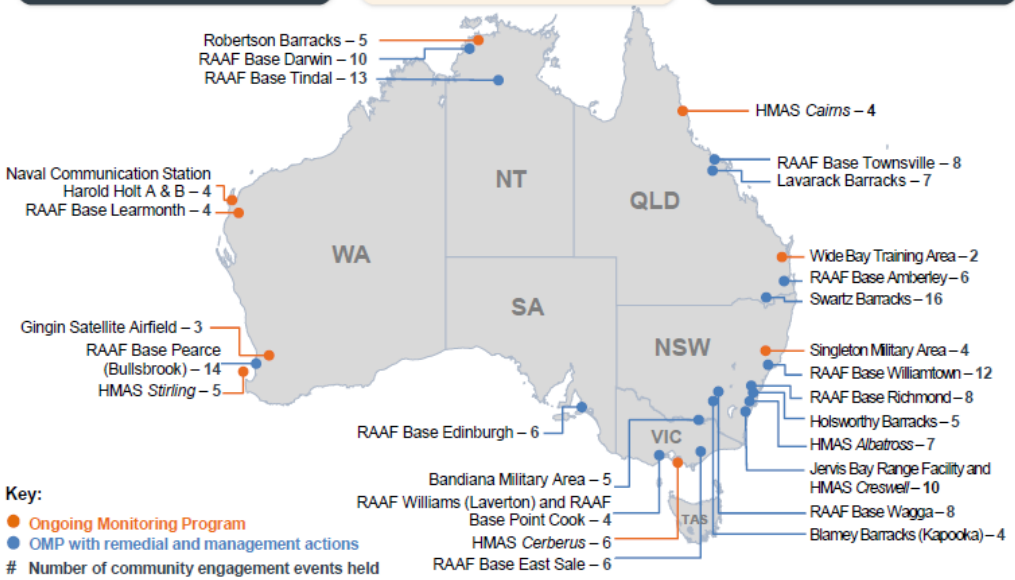
FINANCIAL FACTS

$850m invested to manage, remediate and conduct research

INCLUDING

provided to **$27m** other government agencies for research into health and remediation

$165.4m allocated in FY 2024-2025 to manage and remediate PFAS

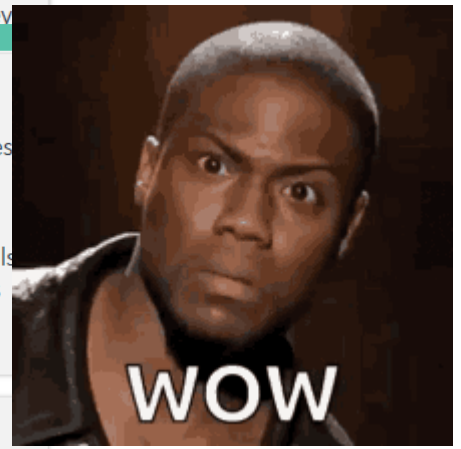


COMMUNITY EVENTS

Defence has held 185 engagement

Recent events

- 13 February 2025 – Jervis Bay Range Facility and HMAS *Creswell*
- 5 December 2024 – RAAF Base Williamtown
- 27 November 2024 – Swartz Barracks
- 16 October 2024 – RAAF Base Tindal
- 15 October 2024 – RAAF Base Darwin
- 6 August 2024 – RAAF Base Amberley



RESEARCH ACTIVITIES

Defence collaborates internationally to share its learnings and to ensure the best remedial actions are implemented on PFAS impacted bases.

Since 2016, Defence has supported trials of new remediation technologies. Trials such as soil stabilisation form part of Defence's remediation approach.

RESEARCH FUNDING

Defence has provided approximately $26 million in funding for 21 research and technology programs to support PFAS investigation and remediation activities.

Defence provided over $27 million in additional funding to other government agencies to support PFAS-related health and remediation research.

Sources

Sources

- Primary sources – where PFAS has been used
  - Military bases
  - Airports
  - Fire-training facilities
- Secondary sources – facilities that receive waste & wastewater containing PFAS
  - landfills
  - wastewater treatment plants

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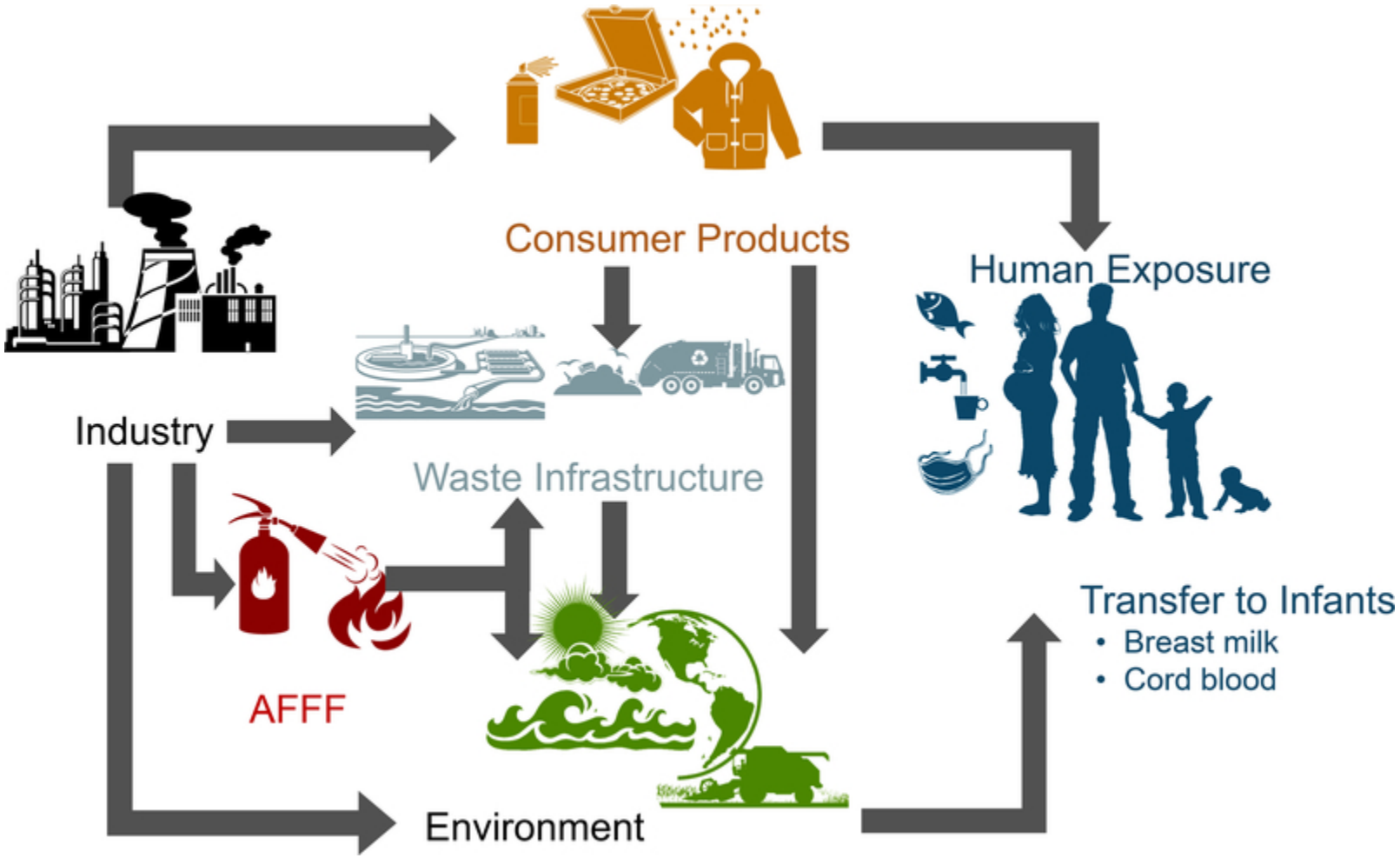

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Sunderland EM, Hu XC, Dassuncao C, Tokranov AK, Wagner CC, Allen JG. *A review of the pathways of human exposure to poly- and perfluoroalkyl substances (PFASs) and present understanding of health effects*. J Expo Sci Environ Epidemiol. 2019 Mar;29(2):131-147. doi: 10.1038/s41370-018-0094-1. Epub 2018 Nov 23. PMID: 30470793; PMCID: PMC6380916.

PFAS sources/industries

- PFAS NEMP v3.0 has 4 pages of table on PFAS sources
- If you really want to know about PFAS in products…

Environmental Science
Processes & Impacts

ROYAL SOCIETY OF CHEMISTRY

PAPER

View Article Online
View Journal | View Issue

Check for updates

Cite this: *Environ. Sci.: Processes Impacts*, 2020, **22**, 2345

An overview of the uses of per- and polyfluoroalkyl substances (PFAS)†

Juliane Glüge,[*a] Martin Scheringer,[a] Ian T. Cousins,[b] Jamie C. DeWitt,[c] Gretta Goldenman,[d] Dorte Herzke,[ef] Rainer Lohmann,[g] Carla A. Ng,[h] Xenia Trier[i] and Zhanyun Wang[j]

Table C1 Activities associated with PFAS contamination due to fire risk

Activity	Description
Airports and aviation infrastructure	On-site firefighting – see also further information below
Aluminium production	On-site firefighting
Battery production	On-site firefighting – see also further information below
Bitumen production	Kerosene use and storage
Brewing, distilling and refining	Ethanol production
Coal works	On-site firefighting
Dangerous goods production	On-site firefighting – likely to use specialised firefighting products and systems due to the presence of a range of hydrocarbons, polar solvents etc
Explosives production	On-site firefighting – explosions
Food production	On-site firefighting associated with use of bulk oils and solvents – see also further information below
Fuel exploration, assessment, production, transport and storage including petrochemicals, other fossil fuels and renewable liquid fuels	On-site firefighting, also used as a surfactant for gas well stimulation
General chemical storage	On-site firefighting – likely to use a range of hydrocarbons, polar solvents etc
Generation of electrical power	On-site firefighting – see also further information below
Hardware retailers	Firefighting foam deluge systems – see also further information below on the construction industry

continues

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Guidance & regulation

PFAS guideline levels (in Australia)

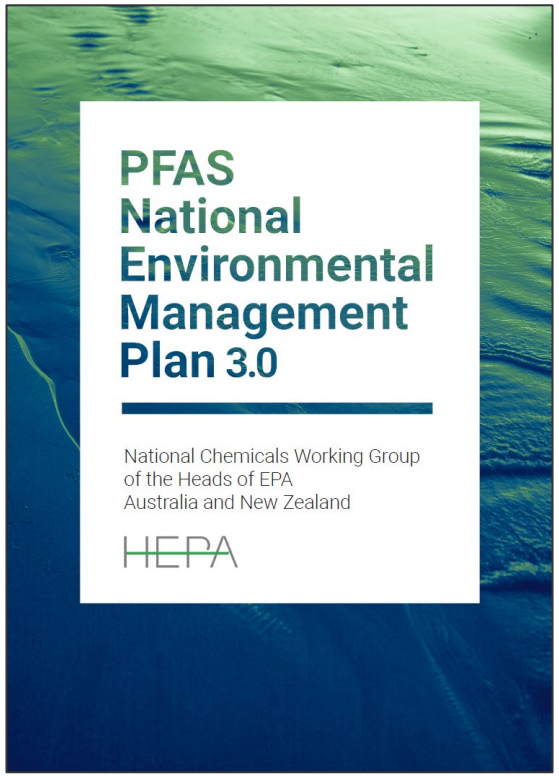

Table 4 Health-based guideline values developed by health authorities

Description	Sum of PFOS and PFHxS[a]	PFOA	Comments and source
Tolerable daily intake (TDI)	0.02µg/kg$_{bw}$/day	0.16µg/kg$_{bw}$/day	FSANZ 2017
Drinking water quality guideline	0.07µg/L	0.56µg/L	NHMRC 2011 New Zealand Government Department of Internal Affairs 2022
Recreational water quality guideline[b c]	2µg/L	10µg/L	NHMRC 2019

a Where the criteria refer to the sum of PFOS and PFHxS, this means concentrations of PFOS only, PFHxS only, and the sum of the two.
b NHMRC (2019) notes that people's use of recreational water is not the same, given Australia's climate and geography. Some recreational water resources may be used less frequently than the assumed guidelines (150 days/year), and (in rare cases) some may be used more frequently. For example, surfing activities may be longer in duration and higher in ingestion risk, compared to NHMRC assumptions. In such cases more locally appropriate recreational guidance based on actual event frequency can be considered in consultation with the state or territory health regulator.
c The guidelines address natural fresh, estuarine and marine recreational water bodies but specifically exclude swimming pools, spas and hydrotherapy pools (NHMRC 2008).

Table 8 Ecological water quality guideline values

Exposure scenario	Guideline value	PFOS µg/L	PFOA µg/L
Freshwater[a]	99% species protection – high conservation value systems[b]	0.00023	19
	95% species protection – slightly to moderately disturbed systems[c]	0.13	220
	90% species protection – highly disturbed systems	2	632
	80% species protection – highly disturbed systems	31	1824
Interim marine[d]	99% species protection – high conservation value systems	0.00023	19
	95% species protection – slightly to moderately disturbed systems	0.13	220
	90% species protection – highly disturbed systems	2	632
	80% species protection – highly disturbed systems	31	1824

Data source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality – interim default guideline values for PFOS and PFOA (ANZG 2023).

a The interim guidelines do not account for effects which result from the bioaccumulation and biomagnification of toxicants in air-breathing animals or in animals which prey on aquatic organisms.
b The 99% species protection level for PFOS is close to the commercially available ultra-trace level of detection. Agencies may wish to apply an 'ultra-trace detect' threshold in such circumstances rather than a quantified measurement.
c The WQG advise that the 99% level of protection be used for slightly to moderately disturbed systems. This approach is generally adopted for chemicals that bioaccumulate and biomagnify in wildlife. Environmental regulators may specify, or environmental legislation may prescribe, the level of species protection required, rather than allowing for case-by-case assessments.
d Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally agreed process under the WQG. The WQG advise that in the case of estuaries, the most stringent of freshwater and marine criteria apply, taking account of any available salinity correction. Marine guideline values developed by CRC CARE are under consideration through the nationally agreed water quality guideline development process.

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US EPA National Primary Drinking Water Regulation

- www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas

Compound	Final MCLG	Final MCL (enforceable levels)[1]
PFOA	Zero	4.0 parts per trillion (ppt) (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

[1] Compliance with MCLs is determined by running annual averages at the sampling point.

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USEPA Announcement on May 14, 2025 Signals a Different Approach

Rescind and Reconsider

- Only keep MCLs for PFOA and PFOS (4 ppt)
- PFOA and PFOS drive treatment for most utilities

Extend Compliance Deadline

- Investigations and supply chain challenges
- Running annual average may require treatment ahead of deadline

PFAS OUTreach Initiative

- Connect with utilities requiring treatment
- Provide assistance and technical support

Others

- Federal exemption framework
- "Hold Polluters Accountable"
- Continued litigation expected

Complex web of responsibilities for chemical regulation

Approvals / registrations

Industrial Chemicals / IChEMS
DCCEEW

Australian Government
Department of Climate Change, Energy, the Environment and Water

Therapeutic Goods
TGA

Australian Government
Department of Health, Disability and Ageing
Therapeutic Goods Administration

AgVet Chemicals
APVMA

Australian Government
Australian Pesticides and Veterinary Medicines Authority

Food additives etc.
FSANZ

FOOD STANDARDS Australia • New Zealand
Te Mana Kounga Kai – Ahitereiria me Aotearoa

EPBC Act Basel, Rotterdam & Stockholm Conventions

Australian Government
Department of Climate Change, Energy, the Environment and Water

Implementing / 'policing'

Operational
POEO Act
Waste Avoidance and Resource Recovery Act

NSW DPIRD | NSW Food | NSW Health

Legacy
CLM Act

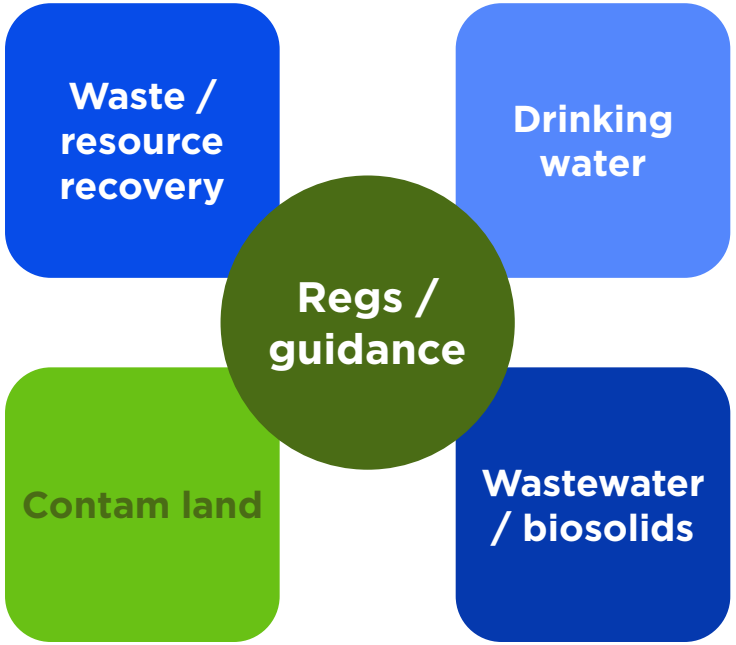
AgVet
Pesticides Act
Fertilisers Act

NSW DCCEEW

Food and Health
Poisons and Therapeutic Goods Act
Food Act

Water and Biodiversity
Water Management Act
Biodiversity Conservation Act

Guidance relevant to water



- FSANZ tolerable daily intake and food triggers 2017
- Australian Drinking Water Guidelines 2011
- Per- and Poly-fluoroalkyl Substances National Environmental Management Plan v3.0, 2025
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018
- The National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013
- Industrial Chemicals Environmental Management Standard (IChEMS)
- enHealth – Human Health Risk Assessment Guidance / exposure factors

PFAS NEMP 3.0

Biosolids
- Guidance and guidelines ✓ ✓

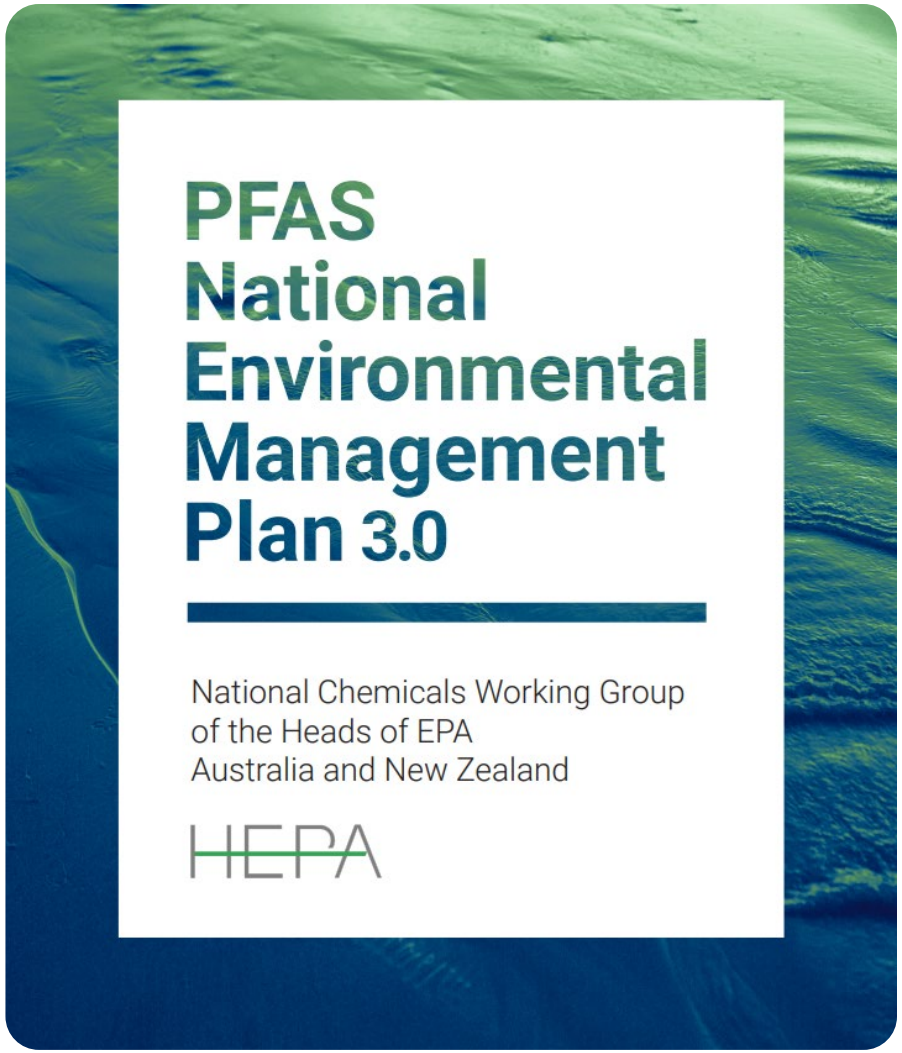
Wastewater
- Framework/guidance ✓
- Effluent guidelines ✗

Water
- Drinking and ecological ✓ ?

Soil
- Human and ecological ✓ ✓

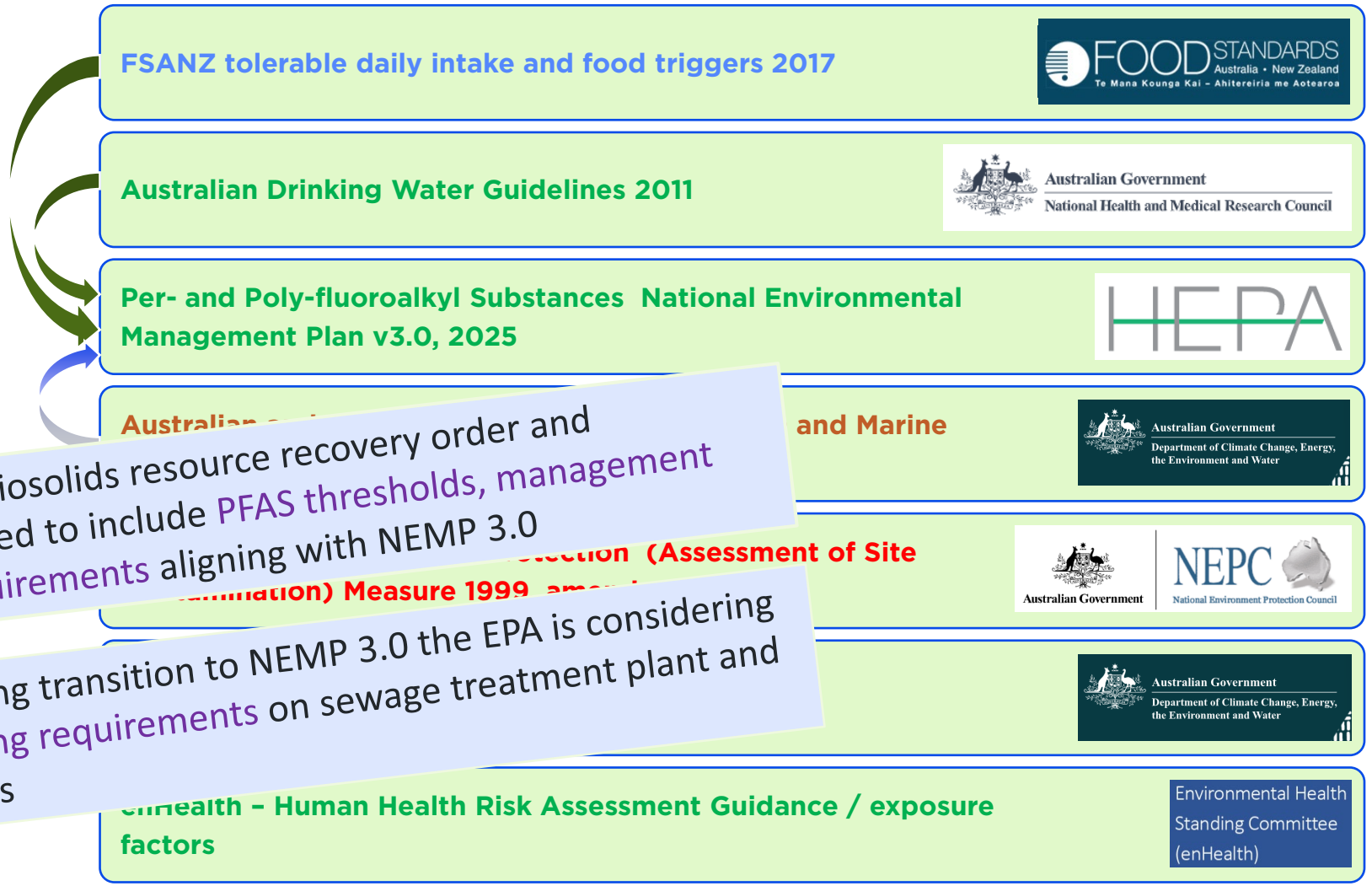
Sediments ✗

Food ✗



Changes/updates

- Specific guidance values for three or four PFAS
- Increasing monitoring requirements appearing in state regs



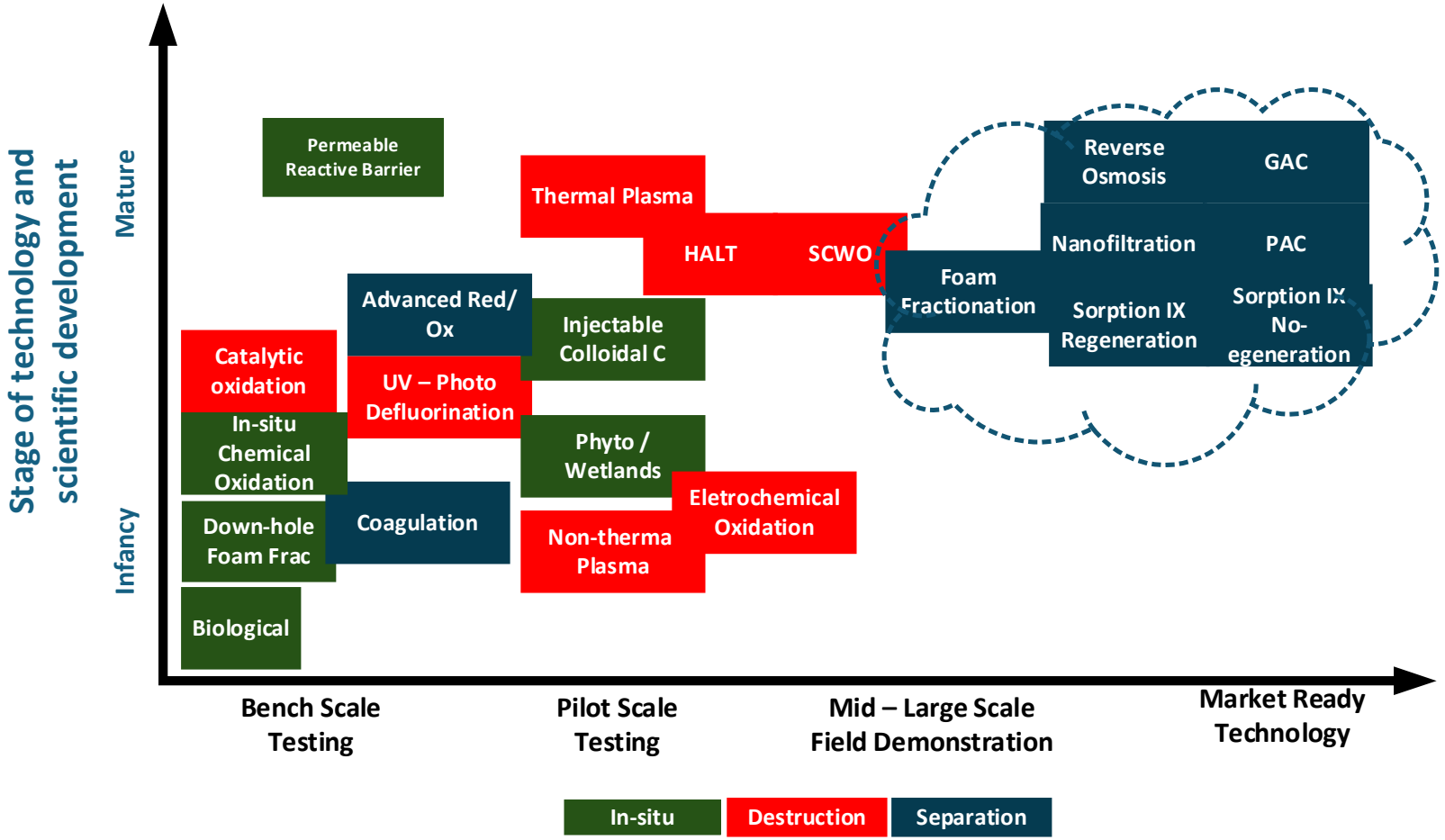
NSW EPA: new Biosolids resource recovery order and exemption drafted to include PFAS thresholds, management and testing requirements aligning with NEMP 3.0

NSW EPA: during transition to NEMP 3.0 the EPA is considering PFAS monitoring requirements on sewage treatment plant and landfill licences


“Solutions”

Water Treatment Technology and Maturity

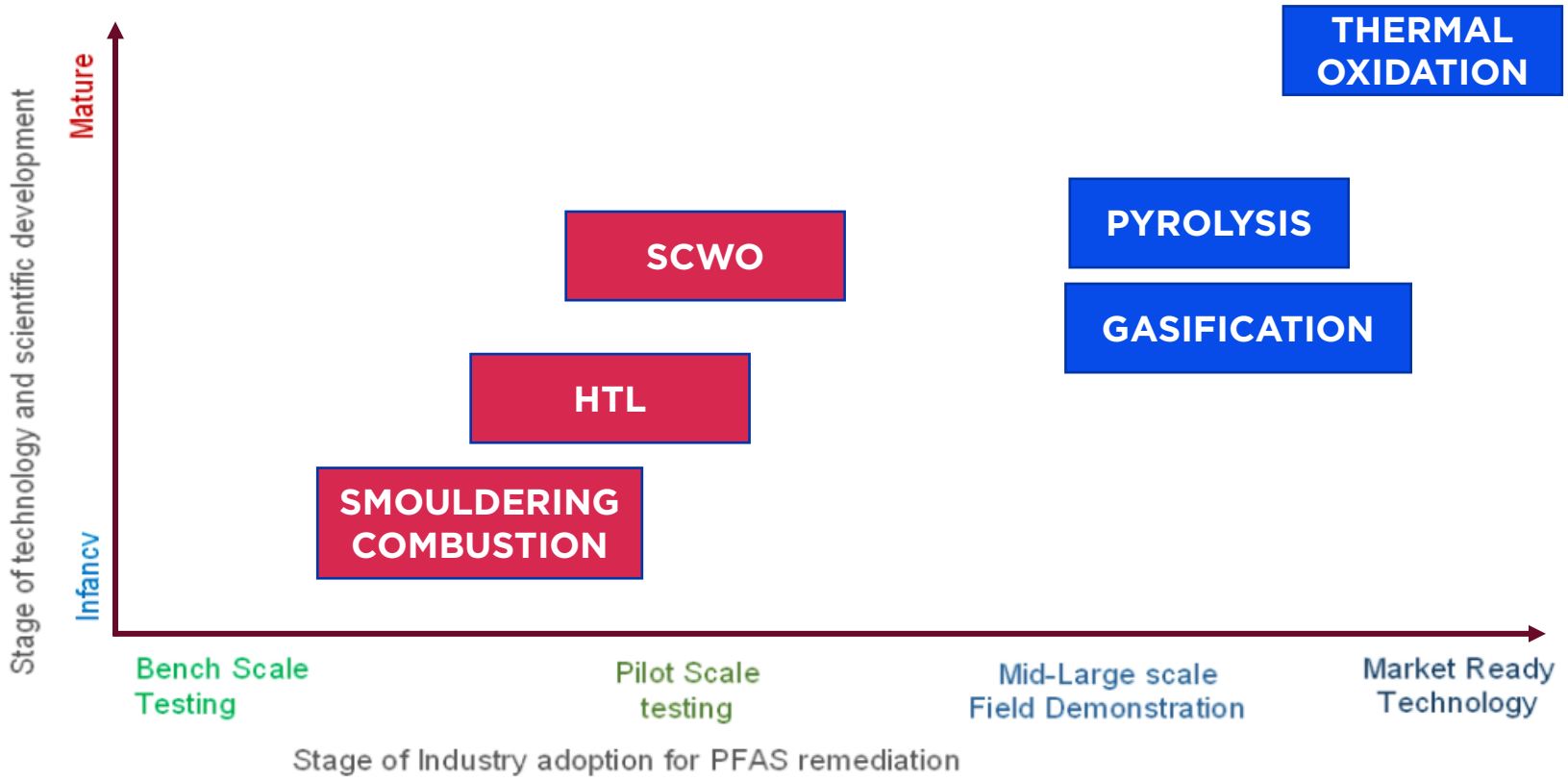
- Most advanced technologies are non-destructive (blue box):
  - removal onto a solid phase
  - using a membrane (RO)
  - Foam fractionation
- Destructive technologies (red box) are still emerging
- Destructive technologies may only make sense as part of a treatment train
- Separation technologies (in cloud) are considered by USEPA to be best available technologies



Source: Modified from ARC PFAS Special Research Initiative. Overview of PFAS Substances Remediation Technologies: Background Literature Review and Technology Assessment. University of QLD et al. 2023.

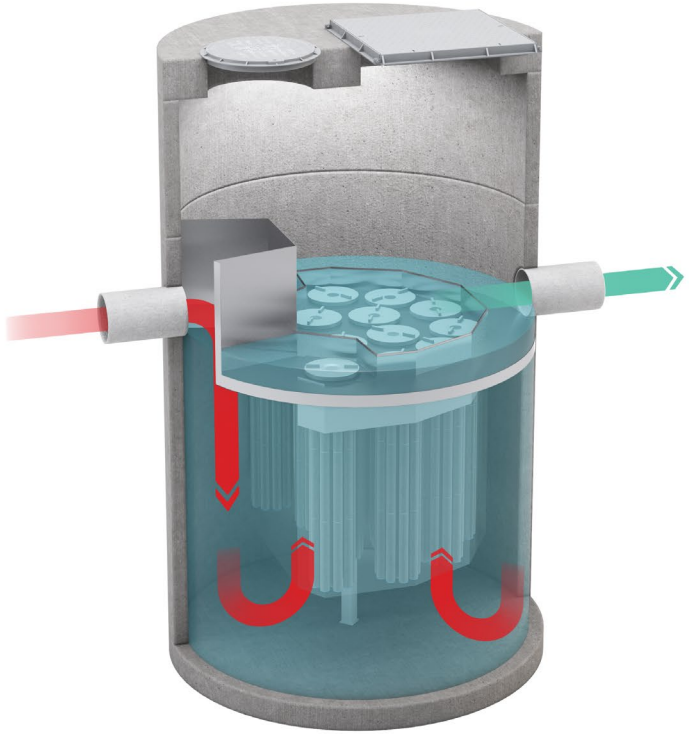
Biosolid Treatment

- PFAS Removal Technologies Significantly Reduce Hauling Costs
- Technologies outlined in blue are considered best available technologies by USEPA
- Analytical Advancements - Emerging methods (OTM-45, 50, 55) enable detection of chemicals that conventional methods don't, driving demand for updated supplier data



Ocean Protect PFAS treatment system

Ocean Protect PFAS treatment system



Pre-treatment
(e.g. via Jellyfish)

+

Filter media for
PFAS removal

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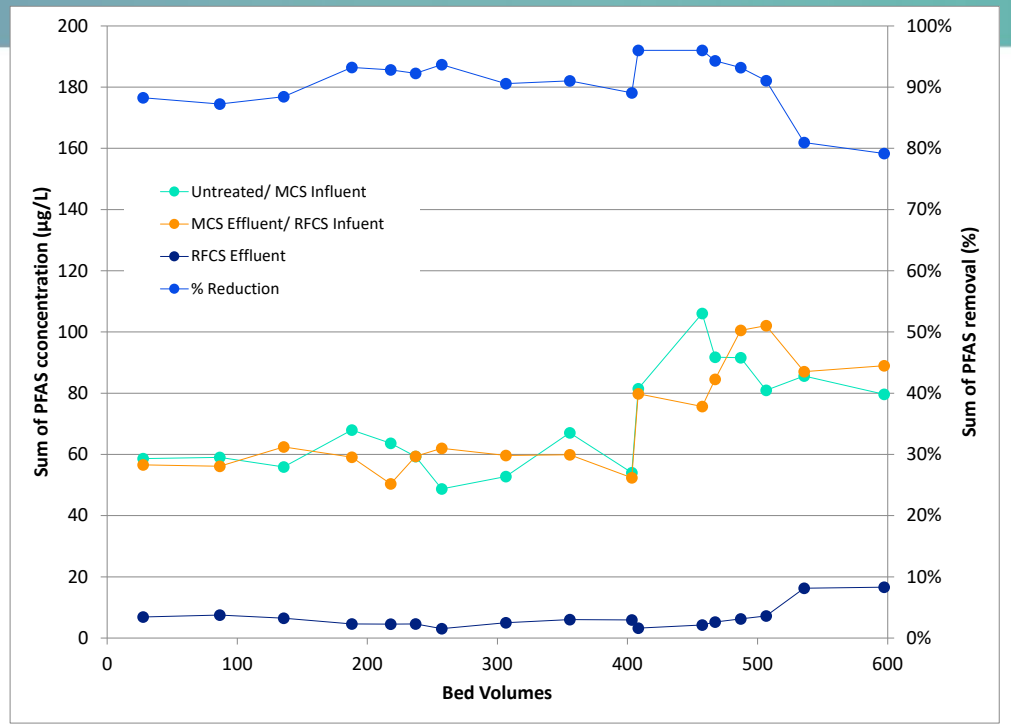
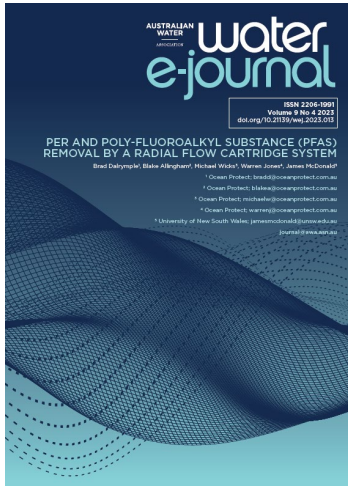
Ocean Protect PFAS treatment system



Example results



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Applications

- Treatment of PFAS-contaminated surface waters
  - Military bases
  - Airports
  - Fire-training facilities

Further info at:
www.oceanprotect.com.au/opus-filter

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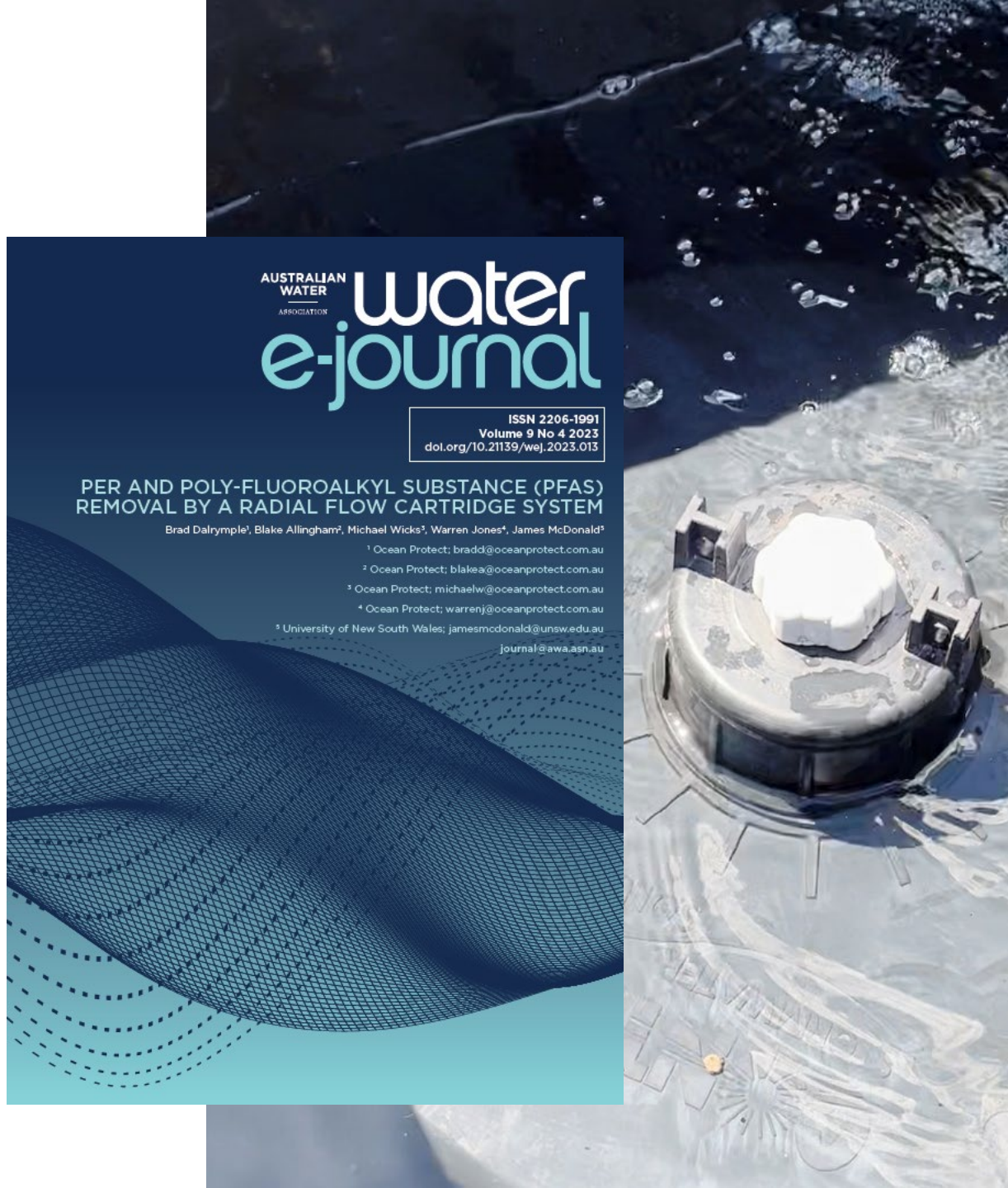
Key advantages

- Proven performance
- Turn-key solution
- Passive
- Underground
- Multiple ‘pass’ possible
- Remote monitoring
- Independently authored O&M guidance & SWMS’s
- Easy integration
- Lower costs



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THANK YOU

Jacobs

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Dr Karl Bowles
Senior Principal Environmental Scientist
karl.bowles@jacobs.com

Brad Dalrymple
Principal Environmental Engineer
bradd@oceanprotect.com.au