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National Toxics Network Submission to the Inquiry into the Management of Per- and Polyfluoroalkyl Substances (PFAS) Contamination in and around Defence Bases

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National Toxics Network (NTN) is a NGO (non-government organisation) network working for pollution reduction, protection of environmental health and environmental justice. NTN is the Australian focal point for the International POPs Elimination Network (IPEN) and strives to achieve the full implementation of the *Stockholm Convention on Persistent Organic Pollutants (POPs)* 2001 and other relevant international and regional chemical and waste treaties. NTN is committed to a toxics free future.

NTN Senior Advisor has participated in the U.N. Stockholm Convention's technical working groups for PFOS and PFOA since 2004 and was a guest presenter at the 'OECD Workshop on Perfluorocarboxylic acids (PFCAs) and Precursors - why international action is needed'. She was a member of the UN Expert Group on Climate Change and Chemicals and a co-author of the report 'Climate Change and POPs; Predicting the Impact'. NTN's Senior Researcher is a member of the Stockholm Convention BAT/BEP Expert Group and the Small Inter-sessional Working Group (SIWG) of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1992).

NTN committee members have participated in a range of state and national government advisory bodies including:

- Participant in the UN working groups for PFOS, PFOA, PFHxS
- NGO Observer to the POPs Review Committee
- National Advisory Body on Scheduled Waste
- HCB Management Plan Panel
- Stockholm Convention Reference Group
- Hazwaste Act Policy Reference Group
- Dioxin Consultative Group
- NTN Observer on Hazwaste Technical Advisory Group
- National Industrial Chemicals Notification Assessment Scheme (NICNAS) Technical Advisory Group
- NICNAS Community Engagement Forum
- NICNAS Strategic Consultative Committee
- Australian Pesticides and Veterinary Medicines Authority Advisory Committees

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An Urgent Call for Action

PFAS chemicals cannot break down. They have no environmental degradation mechanisms (eg hydrolysis, photolysis, or biodegradation). PFAS accumulate in the environment and in all living things, including humans. PFAS can damage the endocrine and reproductive system and the immune system of humans and wildlife. While, the focus has been primarily on PFOS, PFOA and PFHxS, these represent only three of the estimated 4,730 PFAS chemicals in use today. Information on toxic effects and environmental fate exists for only a handful. With the ability of all PFAS to travel via air and water, urgent national and international action is warranted and well overdue.

The Australian government has been discussing PFOS since the turn of the century. This is the 4th inquiry into PFAS contamination held by Australian governments. Yet, few recommendations have been adopted and minimal action has been taken to protect affected communities or the environment from the toxic contamination of these PFAS 'forever' chemicals.

PFAS contaminated sites ignored

This inquiry again focuses on Department of Defence sites. There has been no inquiry into the impacts of PFAS contamination from other important sources, such as airports, wastewater treatment plants and sewerage outfalls.[1] Airports in Sydney, Melbourne, Darwin, Brisbane, Gold Coast, Bundaberg, Tamworth and numerous others have reported high PFAS contamination moving outside the airport boundaries. Residents and workers associated with these sites have been simply ignored.

Wastewater treatment plants (WWTPs) are important point sources for PFAS to the aquatic environment with Australian water reclamation and recycling plants, reporting PFOS, PFOA, perfluorohexanesulfonate (PFHxS) and perfluorohexanoic acid (PFHxA) as the most frequently detected PFAS.[2] In Australia, PFOA has been recorded in every sample of leachate from landfills, evaporation and aeration pond. [3]

PFAS have also been found in Australian drinking water collected from 34 locations including capital cities and regional centres. PFOS and PFOA were the most commonly detected; 49% and 44% of all samples respectively.[4]

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[1] Thompson J, Eaglesham G, Reungoat J, Poussade Y, Bartkow M, Lawrence M, Mueller JF (2011) Removal of PFOS, PFOA and other perfluoroalkyl acids at water reclamation plants in South East Queensland Australia, *Chemosphere* Vol 82: 9–17

[2] Thompson J, Eaglesham G, Reungoat J, Poussade Y, Bartkow M, Lawrence M, Mueller JF (2011) Removal of PFOS, PFOA and other perfluoroalkyl acids at water reclamation plants in South East Queensland Australia, *Chemosphere* Vol 82: 9–17

[3] Perfluorinated Compounds (PFCs) in Landfill leachate, http://www.alsglobal.com/~/media/Files/Divisions/Life%20Sciences/Environmental/Environmental%20Resources/Australia/Enviromail%20Technical%20Newsletters/EnviroMail-86-Perfluorinated-Compounds-PFCs-in-the-Landfill-leachate-February-2015.pdf

[4] Jack Thompson, Geoff Eaglesham, Jochen Mueller (2011) Concentrations of PFOS, PFOA and other perfluorinated alkyl acids in Australian drinking water. *Chemosphere*, Vol. 83/10, 1320–1325

There has been no national assessment of these sources or of the scope and number of PFAS contaminated sites.

PFAS have also been found in the wider Australian environment, contaminating creeks, rivers, aquifers, wetlands and ecosystems. Yet, there has been no national assessment of PFAS impacts on Australian wildlife and ecosystems, despite clear evidence of exposure.

PFOS Ratification still not complete

After 10 years, the Australian government has still not ratified the listing of PFOS on the Stockholm Convention on Persistent Organic Pollutants, despite the majority of national governments having done so. Next year, the Stockholm Convention Conference of Parties is likely to list PFOA and PFHxS at the next COP in 2021. Australia has taken nearly a decade to make a critical decision on one PFAS chemical. The OECD has identified 4,730 PFAS-related CAS numbers,[5] indicating there are 1000s of PFAS chemicals to address, many with little or no information on their toxic effects or environmental fate. This single chemical approach over this timeframe is simply unsustainable and dangerous.

Communities demand cleanup

Communities have demanded that the polluters clean up their mess, remediate contaminated land and destroy the PFAS contamination in an environmental safe manner. As well, they have rightly called for relocation and compensation. The Australian government response is to refuse to acknowledge its liability and reject all consideration of relocation, compensation or buyback.

In the last 2 decades, the Australian government has failed to have any PFAS sites remediated or PFAS wastes destroyed. This failure has resulted in offsite dumping e.g., almost a million litres of water PFAS contaminated water was used in to make NuGrow compost. [6] Similarly, failure to address the management of old stocks of fire fighting foams have seen reports of DOD 'giving away' out of date foams to unsuspecting fire fighters.

The Australian government has failed to implement national PFAS bans to protect its citizens.

Living in a pollution-free world is a basic human right

The protection of the environment is a vital part of contemporary human rights doctrine. It affects the right to life and the right to health. In 2001, the United Nations

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[5] http://www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/

[6] https://www.theaustralian.com.au/news/cancer-toxins-destined-for-compost/news-story/4457d9f52287f23b1b7a7ce9a0b4c303 'Almost a million litres of water contaminated with toxic firefighting chemicals was taken from the RAAF'S Amberley air base last year for use in compost to be sold to the public.'

Human Rights Committee found that *'living in a pollution-free world is a basic human right'* and those who pollute violate these rights. They noted that, *"Human rights cannot be secured in a degraded or polluted environment"* and *"The fundamental right to life is threatened by exposures to toxic chemicals, hazardous wastes, and contaminated drinking water."*

The Convention on the Rights of the Child [7] (CRC) describe a child's right to health, adequate food and clean water, *"taking into consideration the dangers and risks of environmental pollution."* [8] The CRC places an onus on all parties to ensure to the maximum extent possible the survival and development of the child.

Yet many children live in the DOD contaminated 'red zones' with high levels of PFAS evident in their blood.

The unique vulnerability of children to hazardous chemicals is well recognized by WHO, UNICEF and UNEP.[9] Children are not simply little adults. Their bodies are still developing, their detoxification systems are immature and their protective biological barriers such as the blood-brain barrier are still developing. It has also been shown that the placenta cannot be regarded as a barrier to chemical transfer to the foetus. Children react to hazardous chemicals differently from adults.[10] They are also more at risk because they have higher respiration and metabolic rates than adults, they eat and drink more per bodyweight, and they live life closer to the ground, crawling, digging in dirt and putting objects in their mouths. Being unaware of chemical risks, children are less able to protect themselves from exposures and higher skin absorption rates may also result in a proportionally greater exposure.

The high levels of PFAS detected in children in Williamtown and Katherine are of great concern and should be considered a national disgrace.

The human rights obligations in regards to health[11] encompass the right to the enjoyment of the highest attainable standard of physical and mental health. The "underlying determinants of health" include safe drinking water, safe food, healthy working and environmental conditions and health-related education and information. The Australian government has failed to protect these important determinants of health.

Principles of Sound Chemical Management

Since the Australian government was directly made aware of the dangers of PFOS in 2000 by the US EPA, it has failed to adhere to the most basic principles of sound

[7] Convention on the Rights of the Child, opened for signature 20 November 1989, 1577 UNTS 3 (entered into force 2 September 1990). Australia ratified the CRC on 17 December 1990. Available athttp://www.unicef.org/crc/
[8] Article 24 2(c) To combat disease and malnutrition, including within the framework of primary health care, through, iner alia, the application of readily available technology and through the provision of adequate nutritious foods and clean drinking-water, taking into consideration the dangers and risks of environmental pollution;
[9] Ibid. Also see IFCS Children and Chemical Safety Working Group. 2005. Chemical Safety and Children's Health: Protecting the world's children from harmful chemical exposures - a global guide to resources, October.

[10] Landrigan, P J et al. 1998. Children's health and the environment: A new agenda for prevention research. *Environmental Health Perspectives* 106, Supplement 3:787-794.
[11] OHCHR Fact Sheet No 31 – The Right to Health.

chemical management. The Australian community, particularly affected communities have paid dearly.

The principles of sound chemical management were developed to ensure effective, transparent and equitable activities and outcomes.

- Right to Know and the Right to Participate: the community's right to know what is and has been used and released, the level of contamination and options for remediation. Civil society also has the right to participate meaningfully in chemical decision that affect them.
- No data / No market: when there is no chemical information e.g., absence of a toxicity profile or the lack of analytical standards and techniques to assist detection of PFAS chemicals, there should be no use or release of the chemical product.
- Substitution and Elimination: if there is a safer, better way of achieving outcomes, then this should be substituted for risks otherwise faced. This is highly relevant to the ongoing use of PFAS, where alternatives exists, e.g., effective non fluorine fire fighting foams used by Defense forces and commercial airports overseas. 'Regrettable substitution' is evident in the choice to use alternative PFAS chemicals as substitutes for PFOS.
- Precautionary Principle: where the lack of complete information is not an excuse for lack of protective action.

Failure to ensure the Community Right to Know

PFOS is a listed POPs on the Stockholm Convention on Persistent Organic Pollutants, which Australia has ratified. The Australian government is bound by its articles including Article 10 Public information, awareness and education which requires governments to facilitate *'Public participation in addressing persistent organic pollutants and their health and environmental effects and in developing adequate responses'* and to ensure the community '*has access to the public information which is kept up-to-date.'* The Convention also prescribes that *'information on health and safety of humans and the environment shall not be regarded as confidential.'*

In 2000, the US EPA warned the Australian government that PFOS was a serious hazard to human health and the environment. In the years following, there was clear evidence of pollution events, yet the contamination was kept secret and no public information was provided on actual and potential sites, e.g., defense bases, airports, urban and rural fire stations, sewerage facilities and waste water outflows. This meant those affected were unable to take action to reduce exposure.

The Australian government waited 15 years before informing affected communities in 2014-15.

Failure to ensure the Community's Right to Participate

While all previous POPs management plans were developed by a multi-stakeholder team, opportunities for participation in PFAS management decisions, e.g., through the PFAS National Environment Management Plan were closed to civil society. Meetings to develop the PFAS NEMP while closed to civil society including firefighters actively involved the polluters (DOD, Air Services Australia) and their consultants.[12]

The draft PFAS NEMP was extremely limited but did state that best practice approaches and processes in the management of PFAS '*should draw on accepted current scientific understanding from both domestic and international sources."* Yet, the Australian government continues to ignore *accepted current scientific understanding'* on PFAS health impacts and remains alone in the view *"that there is no consistent evidence that exposure to PFAS causes adverse health effects in humans."*

They dismiss '*accepted current scientific understanding',* including:

- One of the world's largest epidemiology study of 69,000 people exposed to PFOA. The C8 Science Panel, a joint initiative of the U S government, the affected community and the industry concluded that there was a probable link to PFOA exposure for diagnosed high cholesterol, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer and pregnancy-induced hypertension.

- The German Human Biomonitoring (HBM) Commission advice that following evaluation of human epidemiological studies (status: July 2015/May 2016), the HBM Commission concluded effects in the following health areas were well proven, relevant, and significantly associated with exposure to PFOA and/or PFOS. These were fertility and pregnancy; weight of newborns at birth; lipid metabolism; immunity after vaccination, immunological development; hormonal development, age at puberty/menarche; thyroid metabolism; onset of menopause.

- The May 2016 US Environmental Protection Agency advice that human epidemiology data reported associations between PFOS exposure and high cholesterol, thyroid disease, immune suppression, and some reproductive and developmental parameters, including reduced fertility and fecundity while similar human population data reported associations between PFOA exposure and high cholesterol, increased liver enzymes, decreased vaccination response, thyroid disorders, pregnancy-induced hypertension and preeclampsia, and cancer (testicular and kidney).

[12] NTN Submission - Draft PFAS NEMP September 2017 www.ntn.org.au

- September 2016 conclusion of the U.N. Persistent Organic Pollutants Review Committee, (of which Australia is a member) that high cholesterol, inflammatory diseases, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer, pregnancy-induced hypertension, endocrine disruption and impaired neuro - as well as reproductive development have been found to be associated with PFOA exposure in humans. Furthermore, the committee found exposure during a sensitive window of development may have critical effects on metabolic signalling pathways.

- The 2016 U.S. National Institute of Environmental Health Sciences' National Toxicology Program (NTP) evaluation based on the health effects data from 33 human studies, 93 animal studies, and 27 relevant in vitro/mechanistic studies concluding that both PFOS and PFOA are presumed to be an immune hazard to humans.

- The 2018 ATSDR Profile which concluded that perfluoroalkyl exposure (14 PFAS considered) was linked to adverse effects on the liver and cholesterol; cardiovascular effects (pregnancy-induced hypertension and/or pre-eclampsia); endocrine effects and increased risk of thyroid disease; immune effects and decreased antibody responses to vaccines, increased risk of asthma, reproductive effects and increased risk of decreased fertility as well as developmental effects and small decreases in birth weight.

Based on the overwhelming evidence from independent published scientific research and developed countries regulatory assessments, the Australian government is both ill-informed and scientifically unsound to continue to claim *"that there is no consistent evidence that exposure to PFAS causes adverse health effects in humans."*

Due to this scientifically unsound position, Australia's drinking water guidelines are based on out of date information made even worse by inaccurate and biased interpretation.

Failure to collect and provide information on the environmental impacts of PFAS in Australia

The Australian NEMP estimated that a *"single PFAS precursor compounds can create 10 to 20 intermediate transformation compounds with functional groups quite unlike the initial compound."* [13] In 2018, new novel perfluorinated chemicals were identified as potential global surface water contaminants. Perfluoroalkyl ether carboxylic and sulfonic acids (PFECAs and PFESAs) have been found in surface waters in China, U.S., UK, Sweden, Germany, Netherlands and Korea, indicating ubiquitous dispersal and distribution in global surface waters.[14]

[13] PFAS National Environmental Management Plan January 2018 http://www.epa.vic.gov.au/~/media/Files/Your%20environment/Land%20and%20groundwater/PFAS%20in%20Victoria/PFAS%20NEMP/FINAL_PFAS-NEMP-20180110.pdf

[14] Yitao Pan, Hongxia Zhang, Qianqian Cui, Nan Sheng, Leo W. Y. Yeung, Yan Sun, Yong Guo, and Jiayin Dai Worldwide Distribution of Novel Perfluoroether Carboxylic and Sulfonic Acids in Surface Water *Environ. Sci. Technol.*, 2018 Article ASAP DOI: 10.1021/acs.est.8b00829

Also in 2018, Perfluoroalkyl carboxylic acids (PFCAs) were detected in more than 80% of the 30 surface seawater samples from the North Pacific to Arctic Ocean.[15]

PFAS accumulate in the blood, liver and kidney of wildlife such as terrestrial mammals[16], dolphins,[17] birds [18], fish,[19] and other marine wildlife [20] including turtles.[21]

In sampling associated with HMAS Albatross, on the south coast of NSW, high levels of PFAS were found in yabbies, mosquito fish, Australian bass and cattle serum. Despite the acknowledged presence of Eastern grey kangaroo, Red-necked wallaby and Common wombat these species were not sampled.[22]

Elevated levels of PFAS have also been found in fish, eels and ducks from a Gippsland wetland in eastern Victoria connected to the East Sale RAAF base.[23]

PFAS chemicals are toxic to aquatic organisms. Declines in survival rates of zebra fish following PFOS-exposure, was evident over generations.[24] In addition to traditional PFASs, (e.g., PFOS, PFOA, PFHxS, PFBS), over 330 other fluorinated chemicals have been detected in fish livers.[25]

PFAS biomagnify in marine food chains and have been shown to affect the immune function in dolphins and sea turtles. Aquatic organisms such as freshwater male tilapia, marine mussels and Baikal seals have demonstrated PFAS induced oestrogenic effects, hepatotoxicity, inflammation, and chemosensitivity.

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[15] Li L, Zheng H, Wang T, Cai M, Wang P. Perfluoroalkyl acids in surface seawater from the North Pacific to the Arctic Ocean: Contamination, distribution and transportation. *Environ Pollu*t. 2018 Mar 16;238:168-176. doi: 10.1016/j.envpol.2018.03.018. [Epub ahead of print] https://www.ncbi.nlm.nih.gov/pubmed/29554564

[16] Proposal to list perfluorohexane sulfonic acid (CAS No: 355-46-4, PFHxS), its salts and PFHxS-related compounds in Annexes A, B and/or C to the Stockholm Convention on Persistent Organic Pollutants. UNEP/POPS/POPRC.13/4. 2017

[17] Magali Houde, Trevor A.D. Bujas, Jeff Small, Randall S. Wells, Patricia A. Fair, Gregory D. Bossart , Keith R. Solomon, & Derak C.G.Muir, (2006) Biomagnification of Perfluoroalkyl Compounds in the Bottlenose Dolphin (*Tursiops truncatus*) Food Web, *Environmental Science & Technology,* Vol. 40, No. 13, pp4138- 4141; Also see Houde M, Wells RS, Fair PA, Bossart GD, Hohn AA, Rowles TK, Sweeney JC, Solomon KR, Muir DC.,(2005) Polyfluoroalkyl compounds in free-ranging bottlenose dolphins (Tursiops truncatus) from the Gulf of Mexico and the Atlantic Ocean. *Environ Sci Technol*. Sep 1;39(17):6591-8.;

[18] Verreault J, Houde M, Gabrielsen GW, Berger U, Haukas M, Letcher RJ, Muir DC., (2005) Perfluorinated alkyl substances in plasma, liver, brain, and eggs of glaucous gulls (Larus hyperboreus) from the Norwegian arctic. *Environ Sci Technol* Oct 1;39(19):7439-45

[19] Jesus Olivero-Verbel, Lin Tao, Boris Johnson-Restrepo, Jorge Guette-Fernández, Rosa Baldiris-Avila, Indira O'byrne-Hoyos and Kurunthachalam Kannan., Perfluorooctanesulfonate and related fluorochemicals in biological samples from the north coast of Colombia. *Environmental Pollution*, Article in Press.

[20] Gregg T. Tomy, Wes Budakowski, Thor Halldorson, Paul A. Helm, Gary A. Stern, Ken Friesen, Karen Pepper, Sheryl A. Tittlemier and Aaron T. Fisk, (2004) Fluorinated Organic Compounds in an Eastern Arctic Marine Food Web, *Environ. Sci. Technol.,* 38 (24), 6475 -6481

[21] Jennifer M. Keller, Kurunthachalam Kannan, Sachi Taniyasu, Nobuyoshi Yamashita, Rusty D. Day, Michael D. Arendt, Al L. Segars and John R. Kucklick, (2005) Perfluorinated Compounds in the Plasma of Loggerhead and Kemp's Ridley Sea Turtles from the Southeastern Coast of the United States. *Environ. Sci. Technol.,* 39 (23), 9101 -9108

[22]http://www.defence.gov.au/Environment/PFAS/docs/Albatross/Reports/20171116HMASAlbatrossHHERAFullReport.pdf

[23] http://www.abc.net.au/news/rural/2017-10-04/pfas-contamination-found-in-animals-in-gippsland-wetland/9015058

[24] Keiter, S., et al Long-term effects of a binary mixture of perfluorooctane sulfonate (PFOS) and bisphenol A (BPA) in zebrafish (Danio rerio) April 2012 *Aquatic toxicology* (Amsterdam, Netherlands) 118-119:116-29

[25] Yanna Liu , Manli Qian, Xinxin Ma, Lingyan Zhu, and Jonathan W. Martin Nontarget Mass Spectrometry Reveals New Perfluoroalkyl Substances in Fish from the Yangtze River and Tangxun Lake, China *Environ. Sci. Technol.,* Article ASAP DOI: 10.1021/acs.est.8b00779

PFAS altered the toxicity of the tested herbicides,[26] with the toxicity of the herbicide Paraquat doubling with PFOA pre-exposure. When exposure to PFAS mixtures occurs, as in the case of real world exposure, individual toxicity can increase. [27]

Principles of No data / No market

Only very few of the thousands of PFAS have adequate toxicology information. Fewer have full environmental fate data. Yet, the Australian government has overseen the replacement of PFOS based fire fighting foams with other PFAS based chemicals, which remain secret under government commercial confidentiality regimes. Many PFAS do not have analytical techniques enabling their ready identification in the environment.

PFAS are used in a huge range of personal and consumer products particularly clothing, furnishings and kitchen ware. Yet, there has been no investigation of products containing PFAS entering Australia and no adequate assessment of their disposal at end of life.

Principles of Substitution and Elimination

While the current chemicals considered of most concern are PFOS, PFOA and PFHxS, it can be argued that these are the ones that have sufficient information to clearly demonstrate all POPs characteristics of toxicity, persistence, bioaccumulation and long range transport. Studies of other PFAS are already demonstrating POP characteristics and should not be seen as substitutes for PFOS, PFOA or PFHxS.

- **Perfluorobutane sulfonate (PFBS)**, a C4 compound is found in the Arctic and is highly resistant to microbial degradation. It contaminates drinking water and is found in humans, including in children. PFBS is found in rivers and sediment near manufacturing plants and more widely, as a contaminant in rivers and marine biota such as humpback dolphins and finless porpoises. PFBS is also found in wastewater and drinking water treatment plants along with other PFAS where it is persistent to sludge treatment. PFBS is readily taken up in maize. PFBS is not well-characterized toxicologically but has been found to disrupt lipid assemblies, modulate immune response in vitro, inhibit aromatase in human placental cells and alter heart rates and behavior in zebra fish.

- **Perfluorobutanoic acid (PFBA**) another C4 fluorinated compound, like PFBS is found in the Arctic and in human blood. PFBA contaminates oceans, lakes, marine fish, rivers, and lakes. PFBA is found in wastewater effluent of sewage treatment plants. Like PBFS, PFBA is also efficiently translocated into plants and it is transferred to crops grown.

[26] Rodea-Palomares et al., Effect of PFOA/PFOS pre-exposure on the toxicity of the herbicides 2,4-D, Atrazine, Diuron and Paraquat to a model aquatic photosynthetic microorganism, *Chemosphere* June 2015 139:65-72
[27] Ding G1, Zhang J, Chen Y, Wang L, Wang M, Xiong D, Sun Y. Combined effects of PFOS and PFOA on zebrafish (Danio rerio) embryos. *Arch Environ Contam Toxico*l. 2013 May;64(4):668-75. doi: 10.1007/s00244-012-9864-2. Epub 2013 Mar 12.

- **Perfluorohexanoic acid (PFHxA)** is already measured in human blood, amniotic fluid and human milk and although it is not well-characterized toxicologically, it has been shown to act as a developmental toxicant in Xenopus embryos in vitro, decrease survival in female Sprague Dawley rats and is negatively associated with altered testosterone levels in male adolescents.

- **Perfluorononanoic acid (PFNA)** is used as surfactant and a breakdown product of precursor compounds such as fluorotelomer alcohols (FTOH), used industrially and in consumer products. PFNA is a developmental and immune system toxicant. It has been measured in biota including in marine mammals e.g., seals, dolphins and pilot whales in remote Arctic and Antarctic regions.

The Australian government has failed to address the risks posed by PFAS use, its wastes and resultant contamination. The main polluters; Department of Defence OD and Air Services Australia have been left to self-regulate and hide behind claims of commercial confidentiality. The last two decades have been noted for their secrecy and inaction. Residents and workers including fire fightewrs have been kept in the dark about the impacts of PFAS and the scope of contamination. They have had to fight for access to free blood screening, despite being aware of extremely high levels of PFAS in the blood of some of those tested including children. Residents have been refused compensation or buyout and often had no way out of their contaminated properties and homes. Communities have been given inaccurate and biased health information. The last two decades have been a sober lesson on how NOT to address one of the worst chemical contamination issues Australia has ever experienced.