



# Per- and Poly-Fluoroalkyl Substances (PFAS)

## HEALTH EFFECTS AND EXPOSURE PATHWAYS

### What are PFAS?

*Per- and Poly-fluoroalkyl Substances* (PFAS) are a group of man-made chemicals that have been widely used since the 1950s in household and industrial products that resist heat, oil, stains, grease and water. This included non-stick cookware, food packaging, stain protection applications to fabric, furniture and carpet, and fire-fighting foams. Since 1970, firefighting foams containing PFAS were once used extensively in Australia and elsewhere due to their effectiveness in fighting liquid fuel fires. There are many types of PFAS, with the best known examples being perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA).

PFAS have emerged as compounds of interest as they can travel long distances through soil and water and can get into groundwater. These substances don't break down in the environment and can accumulate in animals, including humans. More recently, PFAS have been found to have contaminated sites where there has been historical use of fire-fighting foams.

In Australia, state and territory regulatory authorities have taken action to reduce the environmental and potential public health risks at sites where there is confirmed contamination with these chemicals.

### How can PFAS affect people's health?

PFAS have not been proven to cause any specific illnesses in humans. However, since these chemicals remain in humans and the environment for many years, it is recommended that as a precaution human exposure to PFAS be minimised.

Research into potential health effects of PFAS is ongoing around the world. To date there is not enough information available to definitively say what, if any, health effects may be caused by exposure to PFAS.

In studies where large doses of PFAS are given to laboratory animals, possible links with effects on the immune system, liver, reproduction, development and benign (non-cancer) tumours have been identified. However, studies in people have not provided definitive results. PFAS behaves differently in the bodies of animals compared to humans, so effects shown in one animal may not mean the same thing happens in humans.

There is no current evidence that supports a substantial impact on an individual's health from PFAS exposure. A number of studies show a link between PFAS exposure and several health effects, however there is limited or no evidence of human disease accompanying these health effects. Further information on these health effects is below. Organisations that study toxic chemicals have concluded that it is not currently possible to identify any definite diseases caused by PFAS due to problems with study designs and contradictions in study results.

As part of the Australian Government's response to PFAS contamination at Defence sites, the Australian National University has been commissioned to undertake an epidemiological study (a health study that looks at patterns of disease in a population) of three sites in Australia – Williamtown in New South Wales, Oakey in Queensland and Katherine in the Northern Territory. This study is expected to add to understanding the effects of PFAS on health in this population.

### What is the evidence telling us so far?

An Expert Health Panel (the Panel) for PFAS was established in late 2017 to advise the Australian Government on the evidence for potential health impacts associated with PFAS exposure and recommend priority areas for future research. The Panel provided its advice to Government in March 2018. The Panel's report is available at [health.gov.au/pfas](http://health.gov.au/pfas).

A number of health conditions have been highlighted for further research based on the evidence so far. These conditions have been mentioned by the Panel and other international health agencies as being possibly linked to PFAS exposure.

An explanation of the evidence available on some of the highlighted health conditions is described below.

### **Does PFAS exposure affect cholesterol levels?**

A number of studies show a possible link between PFAS exposure and increased blood cholesterol. However, the reported increases in blood cholesterol are small. Because of the design of the studies, it can't be determined if PFAS causes the increased blood cholesterol changes or if other factors are involved, such as diet.

### **Does PFAS exposure cause cancer?**

There is no conclusive evidence that exposure to PFAS causes cancer in humans. Some studies have shown a possible link between kidney and testicular cancers and PFAS. In these studies there was no overall increased risk of cancer. In these studies other potential cancer-causing factors such as smoking were not considered. There are also some studies that have not shown a link between cancers and PFAS exposure.

Studies in rats have shown an increase in some types of thyroid cancer. The results are inconsistent, as rates of cancer only increased with one level of exposure. Higher and lower levels of exposure did not increase cancer in the rats.

### **Does PFAS exposure affect kidney function?**

A number of studies show a link between PFAS and reduced kidney function and increased uric acid levels in the blood. The reported increases in uric acid are generally small. From the current studies available, it has not been shown that PFAS exposure causes reduced kidney function and increased uric acid levels, or is linked to kidney disease. PFAS are eliminated from the body by the kidney. People with kidney disease are expected to have reduced elimination of PFAS and therefore higher levels in the blood. It is possible that existing reduced kidney function may have resulted in the higher levels of PFAS and uric acid reported in the studies. This is known as 'reverse causation'.

### **Does PFAS exposure affect the immune system?**

Some studies in animals show that immune problems may be associated with PFAS exposure. Some organisations are saying that PFAS is presumed to be an immune hazard to humans based on these animal studies.

A small number of studies have shown there is a possible link between PFAS and impaired vaccine response. However, internationally, most studies that have observed decreased vaccine response have not found significant increases in incidence of human disease. The overall human evidence for impaired vaccine response is currently considered to be weak. There is no evidence that PFAS exposure leads to more infections.

One study has shown that there is a possible link between PFAS and ulcerative colitis, but no other autoimmune disease. The evidence so far does not show any link between PFAS and autoimmune problems.

### **Does PFAS exposure cause problems during pregnancy?**

There is currently no consistent evidence that exposure to PFAS causes poor outcomes in pregnant women or their babies. Current evidence does not support PFAS being a major cause of pregnancy-induced hypertension, pre-eclampsia or other pregnancy complications. There are some studies that show a lower birth weight in babies born to mothers with higher levels of PFAS in their blood. However, the reported decreases are mostly small and within the normal range for birth weight. Because of the design of these studies, it is not possible to know if PFAS causes this change or if other factors are involved. There are also some studies that have not shown a link between a lower birth weight and PFAS exposure during pregnancy.

### **Does PFAS exposure affect thyroid function?**

There are no consistent links between PFAS and thyroid hormones in humans. Some studies have found links between PFAS exposure and thyroid hormone levels, however the pattern of changes of the different hormones was not consistent and the changes in hormone levels reported in the studies were small and mostly within the normal range.

### **Does PFAS exposure affect reproductive outcomes?**

A number of human studies suggest that there is a link between PFAS exposure and some reproductive outcomes and levels of sex hormones, including later age for starting menstruation (periods), early menopause, delayed puberty and reduced sperm quality.

However the differences found in these studies are generally small and within normal ranges. The findings are also likely to be affected by other variables not measured in the studies or reverse causation.

### **What treatment is available?**

There is no practical treatment available to remove PFAS from the body. As a precaution, ongoing exposure should be minimised in all people.

### **Do I need to be tested for PFAS?**

Individual blood testing for PFAS is not currently helpful to manage any current medical problems or to predict future health problems. All Australians are expected to have some amount of PFAS in their blood due to the wide range of things they have been used for. A broad range of levels would be expected in all communities due to background exposure. There is no level of PFAS that is considered 'normal' or 'abnormal'.

### **How can people be exposed to PFAS?**

People can be exposed to PFAS in their workplace if they are involved in the manufacture or use of PFAS. Outside of the workplace, exposure to PFAS can occur from food, water (ground and surface water) and various consumer products. Dermal (skin) contact with PFAS is not considered a significant exposure pathway.

A number of sites in Australia, including the RAAF Base Williamtown, Army Aviation Centre Oakey and RAAF Base Tindal, are being investigated because firefighting foams containing PFAS were used there in the past. People have potentially been exposed at these sites by drinking contaminated water.

There is currently no consistent evidence that exposure to PFAS causes poor outcomes in pregnant women or their babies. However, unborn babies can be exposed to PFAS through the PFAS in their mother's body. PFAS can also be transferred to babies through breast milk.

### **Should I continue to breastfeed?**

Yes. While some PFAS have been detected in breast milk, the proven health benefits associated with breastfeeding outweigh any potential health risk to an infant from the transfer of PFAS through breast milk. Breastfeeding mothers living in or around sites contaminated with PFAS do not need to stop breastfeeding.

### **How long does it take for PFAS to leave my system?**

The time it takes for PFAS to be excreted from the body is the same for adults and children. In humans, studies suggest that the half-life of PFAS could range from two to nine years.

## How can I reduce my exposure to PFAS?

Reducing PFAS exposure will mean avoiding contaminated sources. The available data from the 24th Australian Total Diet Survey suggests that dietary exposure to PFAS from the general food supply is likely to be low as the majority of samples in studies reported in Australia and elsewhere did not detect these chemicals in testing.

Advice will change depending on where you live and food sources from contaminated areas may have higher levels of PFAS. If you live on or near a contaminated site, please follow the most current advice provided by your state or territory government or the Department of Defence. This information will be available on their websites.

---

## Further information

---

People can feel anxious or concerned for many reasons when PFAS contamination is found in their area. Help is available from your GP or mental health professional. Your GP can also follow up any physical health concerns that you may have. Individuals can also access the digital mental health gateway, Head to Health, which helps connect Australians to information, advice, and free or low-cost phone and online mental health services and support. To seek support for yourself, or to help support someone else, you can access Head to Health by visiting [headtohealth.gov.au](http://headtohealth.gov.au).

### The Department of Health

For further information regarding the Australian Government Department of Health's response to PFAS contamination, including health advice published by the Australian Health Protection Principal Committee (AHPPC) and its subcommittee enHealth, please visit the Department of Health website ([health.gov.au/pfas](http://health.gov.au/pfas)).

Alternatively you can contact the Department of Health by phone on 1800 941 180 or by email: [health.PFAS@health.gov.au](mailto:health.PFAS@health.gov.au).

### The Department of Defence

For further information regarding the Department of Defence's response to PFAS contamination and site specific information please visit the Department of Defence website ([defence.gov.au/Environment/PFAS](http://defence.gov.au/Environment/PFAS)).