

SPRING 2022

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# EDC Insights No.4 - PFAS

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## What are per- or poly-fluorinated alkyl substances (PFAS)?

PFAS are a large group of 9,000 chemical substances which have a carbon-fluorine bond that is extremely hard to break. They persist for a long time, so they are known as “forever chemicals.”

PFAS are widely considered to be an endocrine disrupting group of chemicals because of their ability to mimic the actions of the hormonal and endocrine systems, especially at sensitive periods of development.

Most PFAS chemicals are long chain with more carbon molecules. Short chain chemicals have fewer carbon molecules and are thought to be more toxic.

Two chemicals in this group are of the greatest concern, Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS). Both are also classed as persistent organic pollutants, or POPs.

## Health risks of PFAS

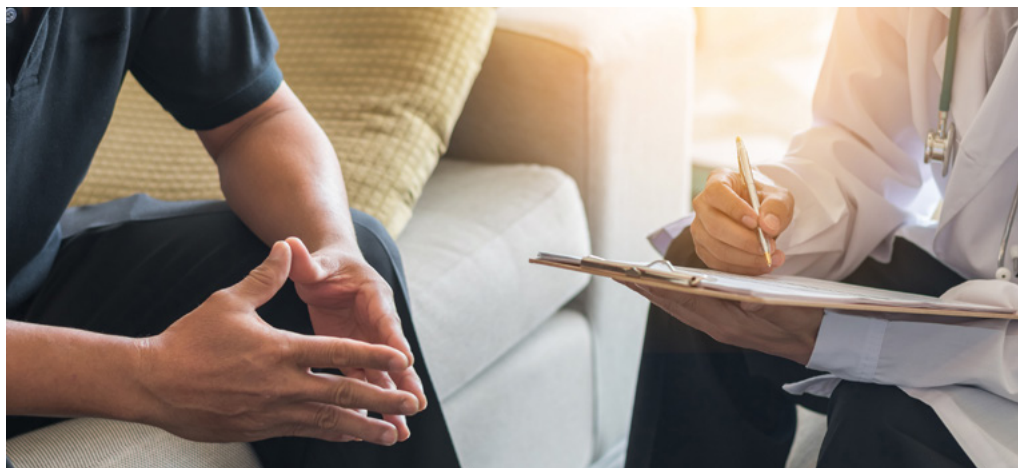
Although these industrial chemicals came to the fore in the 1950’s, we don’t fully understand the risk they pose to our health; the list of health risks is expansive and grows by the day.

It has been estimated that 99% of Americans have PFAS in their blood.

### CANCER

PFAS have long been under scrutiny for the risk of exposure resulting in a cancer diagnosis. One of the largest studies to date was carried out as part of a lawsuit against DuPont, the manufacturers of Teflon. Exposure to PFOA was linked with a range of conditions including cancer, hypertension, raised cholesterol levels, and thyroid disease.

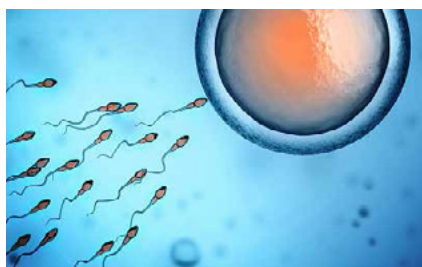
Occupational exposure to PFOA has related to kidney, testicular, and breast cancer. In the US it’s been widely reported that firefighters exposed to PFAS via their protective clothing, and firefighting foam are at a higher risk of cancer. A biomonitoring study based in Australia has also been measuring levels of PFAS in blood plasma and assessing the impacts of PFAS on the health of Aviation Rescue Firefighters.



## BONE DENSITY

Few studies look at the relationship between exposure to **PFAS and bone density**, but researchers have just associated PFAS with lower bone mineral density in adolescent boys. Blood and urine samples were taken from hundreds of adolescent boys and girls as part of the US National Health and Nutrition Examination Survey (NHANES) programme.

Adolescence is a critical period when the body builds bone density, at risk if disrupted by chemicals that can mimic important hormonal functions. Researchers found evidence of elevated levels of PFAS and phthalates in the boys that could be associated with lower bone density. No association was found in adolescent females.



## REPRODUCTION & DEVELOPMENT

Perfluorobutane sulfonate (PFBS) exposure in **laboratory settings** has been associated with adverse developmental effects, including lower body weight, delayed development, and female reproductive effects. Offspring of mothers exposed during pregnancy also saw changes in thyroid hormone levels and cellular changes to the kidneys.

## DIABETES

There is evidence to suggest that exposure to **PFAS increases diabetes risk** in mid-life women.

## LIVER DAMAGE

A review published in April 2022 evaluated evidence of exposure to PFAS and liver damage in both animal based (rodent) studies and human epidemiological studies. Researchers found “consistent evidence” of a **toxic effect from PFAS** in animal studies, and markers to indicate potential liver function in human observational studies.

# Where are PFAS found?



## IN WATER, EVERYWHERE

In the UK there are no statutory standards for permitted levels of PFAS in drinking water. The WHO have not yet established a guideline level, so we don't know what's deemed “safe.”

Drinking water is not routinely tested in UK water, but it is monitored by some water authorities in a variety of settings including rivers and industrial settings. Research commissioned by the UK's Chief Scientist Group found that 10 PFAS substances can be detected widely in the English waters, with the levels of PFAS varying slightly between freshwater and groundwater.

In February 2022, the Cambridge water company informed 1,080 of its customers that they had been exposed to high levels of a restricted substance, perfluorooctane sulfonate (PFOS), but only after it had been removed.

There is no method to remove PFAS from water yet.



### WATER & STAIN-RESISTANT PRODUCTS

PFAS are widely used for their stain and water-resistant properties, including clothing and soft furnishings, so it's extremely hard to avoid in our everyday product choices. Until 2020 PFAS were a key ingredient in Scotchguard before 3M switched it to perfluorobutane sulfonate (PFBS) as a "safer alternative" (we don't know if this is any safer yet).

### CHILDREN'S CLOTHING

A new study tested items to detect substances in the PFAS group in a range of items used by children and adolescents, including clothing, bedding, and furniture. 64% of the products tested had **detectable levels of PFAS**, including some that made claims to be 'environmentally friendly'.

### MAKEUP & TOILETRIES

PFAS are used in a wide range of beauty and skincare products, added as an ingredient to smooth, even out skin texture, or to add radiance. They are permitted for use at specified concentrations. PFAS can be absorbed by the skin.

### CLOTHING & FOOTWEAR

Clothing brands such as Gortex use chemicals in the PFAS group to create water resistance. The risk level is low, although raw material can wear off and be picked up people working in retail, so it could be an occupational exposure risk. There is little scientific data to support this yet.

PFAS are also found in a wide range of clothing to help make them stain resistant and breathable. A report on the state of the American **apparel industry ranked the Top 30 brands** according to their policies and commitment to protecting their customers from the health risks of PFAS. It highlights how easy it can be to promote misleading information to consumers in the absence of restrictions and legislation.



### NON-STICK PRODUCTS

PFOA was widely used by Teflon until 2013 for its non-stick properties until it was substituted by a similar chemical substance, Polytetrafluoroethylene (PTFE) which is largely unregulated. The health risks of PTFE are unknown.

This example highlights the problem that regulations currently apply only on a substance-by-substance basis rather than whole chemical groups, although the path is being laid to **ban entire groups** within the EU.

## FOOD & DRINKS PACKAGING

Single-use plastic used in packaging can leach into **food** and **water** and it persists for a long time due to strong chemical bonds which take a long time to break down.

## Can PFAS be detected in the body?

PFAS can be detected in blood. They are slow to break down and can be stored in body tissue as a **Body Burden**.

## Can you reduce exposure to PFAS?

It is almost impossible to avoid PFAS; particles are found in water, food, air, marine and wildlife, and thousands of everyday products. They can travel far from its source or manufacturing point.

In the case of PFAS we rely heavily on regulators and manufacturers to lead the way with restrictions and less reliance on PFAS.

A helpful guide to finding products and brands that are **PFAS Free can be found here**.

## How are PFAS regulated?

In the UK there are few restrictions, the government follows EC guidance. Regulations apply to only two chemicals in this group, Perfluoro-octanoic Acid (PFOA) and Perfluoro-octane-sulphonate (PFOS).

The US is further ahead of the UK in taking action to restrict the use of PFAS with individual states taking action to restrict it.

The EU plan to **ban 200 chemical substances** in this group from 2023, but that leaves thousands that will still be permitted. The EC will reveal its plan to revise guidance on product labelling in Summer 2022, providing greater transparency on chemicals.

## THE STOCKHOLM CONVENTION

This came into force in 2004, with 154 countries signing up to it. Its purpose is to protect the environment and human health from persistent organic pollutants (POPs), chemicals that do not break down in the environment and persist for hundreds and thousands of years.

The Stockholm Convention operates three lists, **Annex A, B, and C**. Annex A lists substances where all countries must 'take measures to eliminate the production and use of the chemicals listed.' Annex B restricts substances that are not banned outright. Annex C is to reduce unintentional use.

### UK SVHC LIST

The Health and Safety Executive (HSE) enforces a list of **Substances of Very High Concern** (SVHCs) for substances known to have detrimental effects on human health. Substances on the list legally are restricted and manufacturers must apply for permission to use chemicals on the list.

Two substances in the PFAS group appear on the UK list, PFOA and PFOS. They are classed as SVHCs because they are known to be toxic for reproduction or known to have endocrine disrupting properties in human health.

### CHEMICAL SUBSTITUTIONS - THE SIN LIST

ChemSec is the International Chemical Secretariat, an independent non-profit organisation that advocates for substitution of toxic chemicals to safer alternatives. It has developed the **SIN list**. Two PFOA substances and six PFOS substances appear on the list.

## Further reading

WHO & UN Environment Programme **The State of the Science, Endocrine Disrupting Chemicals**

In-depth reading about **science and chemistry of PFAS**

ChemSec **long read - PFAS regulations**

**PFAS movement**