

# FOREVER CHEMICALS

## The Environmental Threat from Toxic PFAS



**MOST COMMONLY FOUND IN**

**FAST-FOOD WRAPPERS & CONTAINERS**

**WATER-RESISTANT CLOTHING**

**PIZZA BOXES**

**DRINKING WATER**

**PLASTIC WATER BOTTLES**

**GREASEPROOF PAPER**

**RIVER SEDIMENT**

**HUMAN BODIES**

**MICROWAVE BAGS**

**NON-STICK COOKWARE**

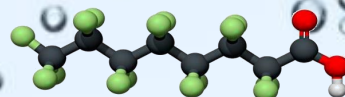
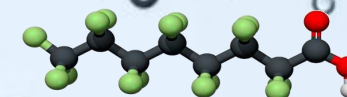
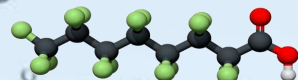
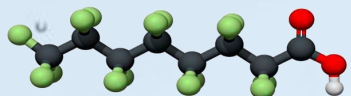
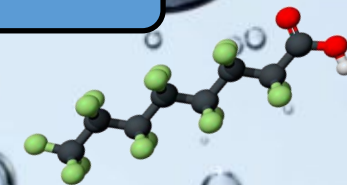
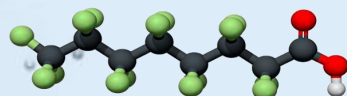
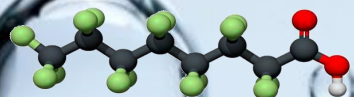
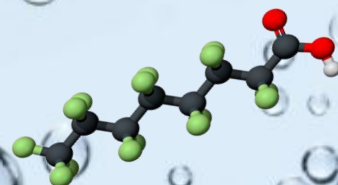
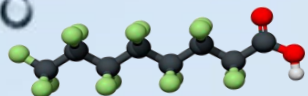
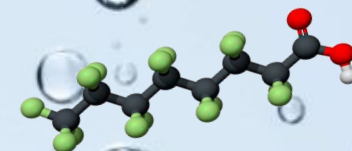
**CLEANING PRODUCTS**

**OCEANS**

**STAIN RESISTANT COATINGS**

**PAINT**

**SWEET WRAPPERS**





**“PFAS persist and accumulate in soil, water, air, wildlife, our bodies.”**

**“PFAS has been found in human breast milk.”**

**“PFAS is found in the blood of 97% of the American population.”**

**“PFAS has been linked to fertility problems and changes in metabolism.”**

**“PFAS has been linked to an increased risk of obesity and some cancers.”**

**“Globally PFAS is found in rivers, lakes and every ocean on our planet.”**

**“PFAS has been detected on Mount Everest. There is no-where that PFAS is not present. It is in the soil, the air and water.”**

**“PFAS is manmade, it is damaging our environment on a daily basis.”**

## FRAGRANCE



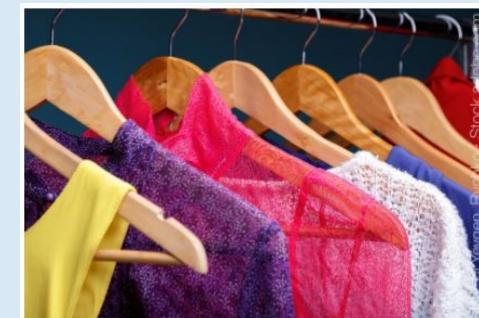
## FLAVOURS



## COSMETICS



## TEXTILES



## MINING



## ENERGY

**ELECTRICITY, GAS, SOLAR,  
ATOMIC, RENEWABLES**



## PETROCHEMICAL

**OIL, GAS, PETROLEUM**



## FOOD



**WINE, BEER & SPIRITS  
TESTING & PRODUCT  
DEVELOPMENT**



## PHARMACEUTICAL



## AGRICULTURAL



## FORENSICS



## ENVIRONMENTAL

**WATER, AIR, SOIL**



## CHEMICAL

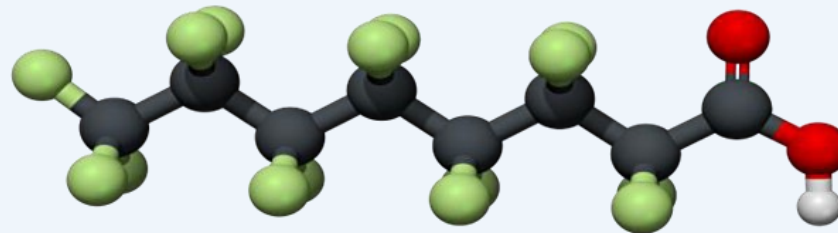


  
**Greyhound**  
CHROMATOGRAPHY  
AND ALLIED CHEMICALS



## General Concepts of Organofluorine Chemistry for PFAS

**Organofluorine Chemistry:** A branch of organic chemistry involving organic molecules with a carbon-fluorine bond. Organofluorine molecules have many commercial uses. They include PFAS, such as PFOA, shown below:



**EXAMPLE: 3D model of a PFOA (perfluorooctanoic acid) molecule, in its acid form.**

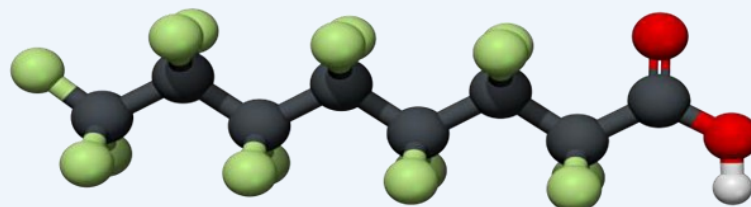
Source: Manuel Almagro Rivas (Own work using: Avogadro, Discovery Studio, GIMP) [CC BY-SA 4.0] (<https://creativecommons.org/licenses/by-sa/4.0/>), via Wikimedia Commons. <https://commons.wikimedia.org/wiki/File:PFOA-3D.png>

Gray spheres represent carbon atoms linked together in a chain; there are eight of them, so “octane” is used in the name. Green spheres represent fluorine atoms bonded to carbon atoms. Red spheres represent oxygen atoms. White sphere represents a hydrogen atom that dissolves away in water, which makes this an acid. Fluorine atoms are attached to all possible bonding sites, making this **per**fluorinated. If some of the fluorine atoms were replaced by other atoms (such as oxygen or hydrogen), it would be **poly**fluorinated. Without the hydrogen, the “head end” takes on a negative charge and can bond to things through electrostatic attraction. The fluorine “tail end” is strong and stable, giving it lipid- and water-repelling properties, but also making it persistent in the environment.

## General Concepts of Organofluorine Chemistry for PFAS

**Isomer:** A molecule with the same molecular formula as another molecule, but with a different chemical structure. **Isomers** contain the same number of atoms of each element, but have different arrangements of their atoms. See [Figure 2-15](#) for an example; linear and branched PFOS contain the same number of carbon, fluorine, oxygen, and sulfur atoms, but these atoms are arranged differently depending on whether it is a linear or branched isomer of PFOS.

**Homologue Groups and Homologous Series:** A group of organic compounds, usually listed in order of increasing size, that has a similar structure (and therefore also similar properties) and whose structures differ only by the number of carbon atoms in the chain. For example, all of the linear and branched isomers of PFOS would be in the  $C_8$  homologue group, while all of the linear and branched isomers of perfluorohexane sulfonic acid (PFHxS) would be in the  $C_6$  homologue group. The  $C_4$ - $C_{12}$  PFASs are a homologous series of perfluorosulfonates.



## **Are all PFAS toxic to humans?**

This is a question that remains to be answered. Research over many years will provide the data needed to analyse the impact PFAS has on the environment. Some PFAS, sometimes used in construction materials are not released into the air or water table when it rains but they are released when buildings are demolished and the debris is sent to landfill.



## **Should we be concerned?**

Some PFAs are of a more immediate concern as they are released into the environment when they are used or when they come into contact with water. Small residual PFAS molecules wash off easily and are carried to the soil, air and water very quickly. Many short-chain PFAS dissolve in water. Gradually, over time, the PFAS sinks to the depths of oceans and rivers, settles in the sediment and becomes a concern as marine life feeds on plants and other animals that are in the sediment. Some PFAS such as PFOA act like detergents, they repel water and rise back to the surface, they are then released into the atmosphere as droplets. Some scientists believe that spray from the oceans is the biggest source of atmospheric PFAS.



**PFAS (per- and polyfluoroalkyl substances), known as “forever chemicals” are found in everyday objects. Food Packaging, paints, cosmetics, wood lacquers, sealants , solar panels, fire fighting foams, artificial grass and many more seemingly innocent products.**

**Generally used to prevent corrosion and make products waterproof and stain-resistant they are present in our everyday life. Unfortunately they do not break down in our environment and as a consequence are “forever present”.**

**PERFLUORO  
POLYFLUORO  
OR FLUORO**

**INDICATES THAT AN  
ITEM CONTAINS PFAS**





## PFAS and Other Toxic Forever Chemicals in Drinking Water



For over 30 years the European Union have worked tirelessly to protect the integrity of our drinking water. EU officials have recently reached a provisional agreement to update the Union's 1998 Drinking Water Directive to tighten up the permissible limits allowed for both PFAS and several other drinking water contaminants, including bisphenol-A, microplastics, lead and chromium. At the time of writing the European Parliament and Council are still to formally approve the proposal.

European drinking water standards currently far exceed the standards set in the United States but this is a changing picture as state by state new instances of contaminants are emerging. Currently, the U.S. Environmental Protection Agency has only issued a non-enforceable health advisory of 70 ppt for PFOA, formerly used by DuPont to make Teflon, and PFOS, formerly an ingredient in 3M's Scotchgard. Those compounds are no longer manufactured in the U.S., but they and other PFAS contaminate the drinking water for an estimated 110 million Americans.



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Of PFAS  
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**PFAS  
REFERENCE STANDARDS**





## Convenience kits for Perfluoroalkyl and Polyfluoroalkyl (PFAS) Testing



**Because Perfluoroalkyl and Polyfluoroalkyl substances do not decompose, they can accumulate over time in the environment and the human body. There is increasing evidence that exposure to PFAS can adversely affect human health. As a result, regulatory bodies are legislating that many materials should be tested to ensure that they do not contain traces of PFAS or that the traces are below permitted legal limits.**

**Because PFAS are widely used in materials such as PTFE, that are commonly used in chemical analysis consumables, laboratories need new labware products to minimize background contamination from these chemicals.**

[VIEW THE FULL RANGE](#)





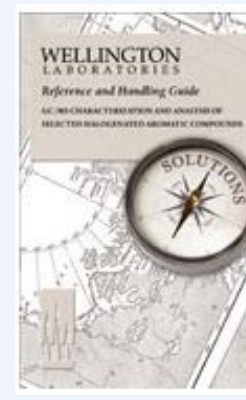
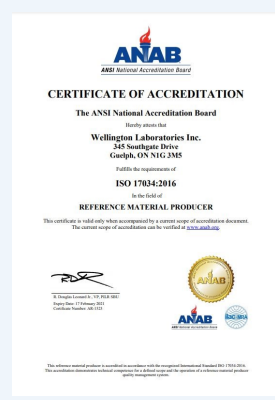
# TESTING FOR PFAS?



**Wellington Laboratories** has been committed to providing high quality reference standards and exceptional customer service since its inception in 1980.

The primary source of Standards for EPA Methods 23, 513, 1613, 1668, 8280, 8290, European Method EN-1948 and World Health/EPA Standards, C13 and Native Dioxins, Furans, PCBs and Brominated Diphenyl Ethers, Brominated Dioxins and Furans, Methylated PCDDs and PCDFs, Fluorinated Compounds and more.

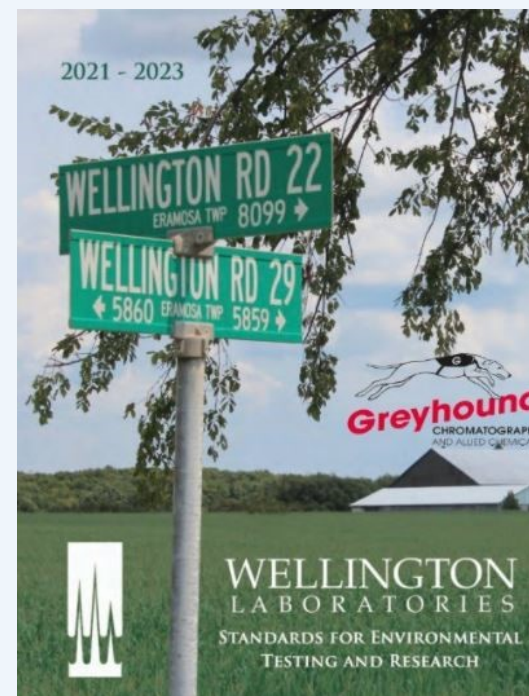
## Wellington's Quality Documents



# Wellington Laboratories Catalogue 2021 - 2023

Wellington Laboratories is pleased to announce the long-awaited release of their latest catalogue which contains the most up-to-date listing of Wellington's Certified Reference Standard Solutions, Solution/Mixtures and Calibration Sets. Below you will find a selection of new products introduced in this new catalogue. Amongst the new products on offer you will find a comprehensive calibration set for polychlorinated naphthalenes (PCNs), native and mass-labelled PCN Support Solutions and additional individual organochlorine pesticide (OPC) standards.

Wellington Laboratories also continue to offer most of the products that were listed in their previous catalogue as they



## NEW ADDITIONS TO WELLINGTON LABORATORIES PRODUCT LIST

**Alternative Method 16130 Calibration Set (16130CVS)**

**Mass-Labelled PCDD Window Defining Mixture (MD5CWDS)**

**Mass-Labelled PCDF Window Defining Mixture (MF5CWDS)**

**PCN Calibration Set (PCN-CVS-A) & Support Solutions**

**24 Mass-Labelled OCP Standards**

**27 Individual Native PCN Standards**

**14 Mass-Labelled PCN Standards**



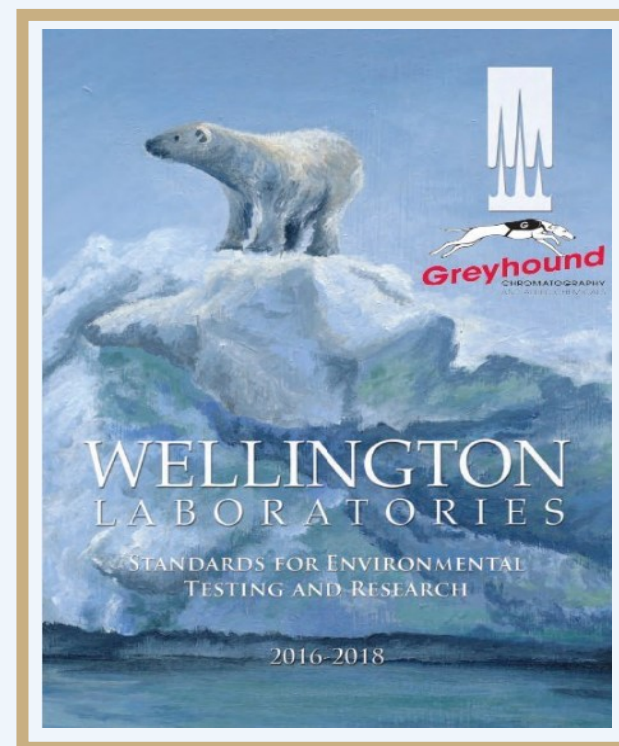


# PFAS Certified Reference Standards

**Per- and Polyfluoroalkyl Substances (PFAS) are an emerging class of environmental contaminants. Their unique properties create a host of analytical challenges that require the use of native and mass-labelled standards for the generation of accurate data.**

The most notable PFAS include PFOS (perfluorooctanesulfonate) and PFOA (perfluorooctanoic acid) and Wellington Laboratories currently offers multiple mass-labelled standards for these compounds to meet your analytical needs. In fact, Wellington offers a large selection of native and mass-labelled per- and poly-fluorinated compounds, including:

- ▶ **Perfluoroalkylcarboxylic Acids (PFCAs)**
- ▶ **Perfluoroalkylsulfonates (PFASs)**
- ▶ **Perfluorooctanesulfonamides (FOSAs)**
- ▶ **Perfluorooctanesulfonamidoethanols (FOSEs)**
- ▶ **Perfluorooctanesulfonamidoacetic acids (FOSAAs)**
- ▶ **Telomer Alcohols (FTOHs)**
- ▶ **Telomer Acids (FTAs)**
- ▶ **Telomer Sulfonates (FTSs)**
- ▶ **Perfluoroalkylphosphonic acids (PFAPAs)**
- ▶ **Perfluoroalkylphosphinic acids (PFPI's)**



**These solutions can be found on pages 141—159 of the current catalogue.**

Wellington started to synthesize perfluorinated compounds in 2004 and, since then, Wellington Laboratories have regularly added new native and mass-labelled standards to their inventory.

- ▶ PFC-C-CVS Calibration Set and Support Solutions
- ▶ Perfluoroalkanesulfonates (PFASs)
- ▶ Perfluoroalkylcarboxylic acids (PFCAs)
- ▶ Perfluorooctanesulfonamides (FOSAs)
- ▶ Perfluorooctanesulfonamidoethanols (FOSEs)
- ▶ Perfluorooctanesulfonamidoacetic acids (FOSAAs)
- ▶ Fluorinated Telomer Alcohols (FTOHs)
- ▶ Fluorinated Telomer Acids (FTAs)
- ▶ Unsaturated Fluorinated Telomer Acids (FTUAs)
- ▶ Perfluoroalkylphosphonic Acids (PFAPAs)
- ▶ Perfluoroalkylphosphinic Acids (X:XPFPi)
- ▶ Polyfluorinated Phosphate Esters (PAPs and SAmPAPs)
- ▶ Fluorinated Telomer Acrylates and Acetates (FTAcrs and



PFCs are still emerging environmental contaminants and each of the groups of compounds listed above pose unique analytical challenges. In addition, the individual isomers, such as the branched PFOA and PFOS isomers, are being found to have different toxicokinetic and ecokinetic properties. Wellington Laboratories' inventory of PFCs will continue to grow.



# PFAS

per- and polyfluoroalkyl substances



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**MN**  
AUTHORISED DISTRIBUTOR  
MACHEREY-NAGEL



Industry



Waste infrastructure



Consumer products



Fire fighting foam



Environment (soil / air / water)  
and human exposure





# Getting the Goods to our Customers



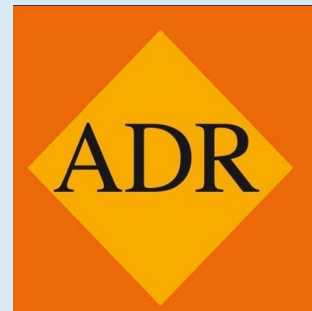
Tired of frustrating telephone calls, late deliveries, no deliveries, lost items, too much form filling, incorrect paperwork, no certification, customs issues, broken promises etc, etc...?



Greyhound will take care of all the paperwork, certification, despatch and transport issues, so you can relax and look forward to receiving your goods.

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Our IATA, ADR (Road) and IMDG (Sea) trained Logistics Department have many year's experience of shipping hazardous and non-hazardous materials around the world. Greyhound prides itself on using our extensive logistics knowledge to facilitate successful delivery of your goods, either to your door or an approved airport.

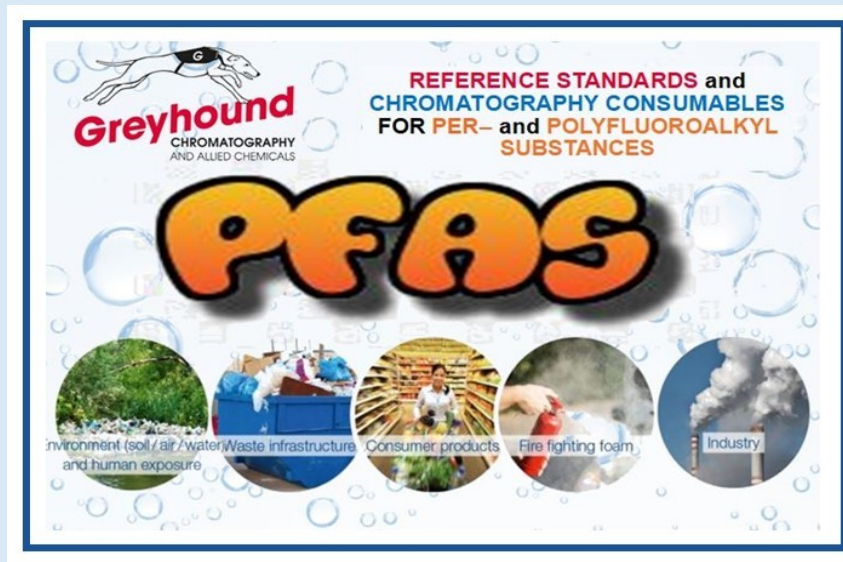


## USEFUL LINKS

[GREYHOUND CHROMATOGRAPHY WEBSITE](#)  
[GREYHOUND CATALOGUE DOWNLOADS](#)  
[WELLINGTON LABORATORIES WEBSITE](#)  
[Q-RANGE PFAS ANALYSIS SCREW TOP VIALS](#)  
[PFAS VIAL SAMPLING KITS](#)  
[MACHEREY-NAGEL PFAS PRODUCTS](#)  
[WELLINGTON LABORATORIES PFAS REFERENCE STANDARDS](#)  
[PFAS FOCUS—PFAS IN DRINKING WATER](#)  
[MIXED NATIVE PFCAs AND PFASs SOLUTION](#)  
[PFOS/PFOA ISOMERS](#)  
[AQUEOUS FILM-FORMING FOAM PFAS](#)



[WWW.GREYHOUNDCHROM.COM](http://WWW.GREYHOUNDCHROM.COM)



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CHROMATOGRAPHY  
AND ALLIED CHEMICALS

REFERENCE STANDARDS and  
CHROMATOGRAPHY CONSUMABLES  
FOR PER- and POLYFLUOROALKYL  
SUBSTANCES

# PFAS

environment (soil / air / water and human exposure) Waste infrastructure Consumer products Fire fighting foam Industry



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**ChemSec** is an international non-profit organization that works to phase out harmful chemicals in favor of safe alternatives. In their work, **ChemSec** wants to create a strong link between researchers, decision makers and companies in the fight against harmful chemicals. By joining **ChemSec's** PFAS movement, companies commit to work towards getting all PFAS chemicals covered by EU's chemicals legislation, REACH, which lists the harmful chemicals banned from use in the EU, phased out from supply chains.



Like a number of other large companies, **Greyhound Chromatography** has joined the Swedish non-profit organization **ChemSec's** PFAS movement. The movement is working to have a number of harmful fluorinated compounds – known as “forever chemicals”, since they don't degrade – phased out and banned.







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