E-BOOK

# VICTREX™ PEEK POLYMERS

# A POTENTIAL PFAS REPLACEMENT

victrex

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# WHAT ARE PFAS & WHY ARE PFAS A CONCERN?

## *PFAS, PER and POLY FLUOROALKYL SUBSTANCES*

PFAS, as defined by the Organisation for Economic and Co-operation and Development (OECD), are any chemicals with at least one perfluorinated methyl group (-CF3) or at least one perfluorinated methylene group (-CF2-)[1].

Per- and Polyfluoroalkyl compounds span a wide range of chemicals. Since the 1950's, they have been extensively used in millions of everyday items. These substances, which are renowned for their resistance to heat, oil, stains, and water, are ubiquitous in a variety of products such as technical clothing, non-stick cookware, food packaging, and many more.

## *SAFETY CONCERNS*

Safety concerns around PFAS has sparked global action. Regulators across the UK, European Union, and the U.S. are proposing to ban or restrict PFAS substances to only a few critical uses.

Considered “forever chemicals” their persistence in the environment poses a significant risk. PFAS, including compounds like PFOA (perfluorooctanoic acid) and PFOS (perfluorooctanesulforic), do not break down and risk contaminating our food and water, which may lead to health hazards such as liver damage, thyroid disease, obesity, fertility issues and cancer .[2]

1 OECD About PFAS

2 European Environment Agency, What are PFAS and how are they dangerous for my health? www.eea.europa.eu

# PACE OF CHANGE

It's difficult to predict the pace of change. However, similar historic changes in the chemical sector have typically involved a short period of rapid change prior to regulation.

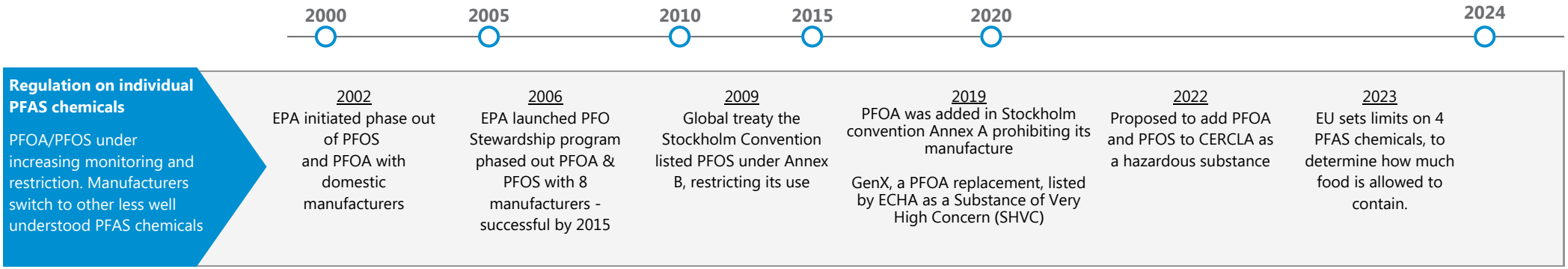
| | Unregulated Use | Understanding of Concern | Compelling Evidence | Regulated Use | Outright Ban |
|---|---|---|---|---|---|
| **PCB's** | 1890 - 46 years - 1936 | 1936 - 30 years - 1966 | 1966 - 12 years - 1978 | 1978 - 8 years - 1986 | 1986 ⟷ Today |
| **CFC's** | 1930 - 44 years - 1974 | 1974 - 11 years - 1985 | 1985 - 2 years - 1987 | 1987 - 17 years - 2010 | 2010 ⟷ Today |
| **Asbestos** | 1880 - 38 years - 1918 | 1918 - 49 years - 1967 | 1967 - 11 years - 1978 | 1978 ⟷ | Usage highly controlled |
| **BPA** | 1950 - 38 years - 1988 | 1988 - 20 years - 2008 | 2008 - 2 years - 2010 | 2010 ⟷ | Used highly controlled |
| **PFOS/A** | 1940 - 20 years - 1960 | 1960 - 20 years - 1980 | 1980 - 22 years - 2002 | 2002 ⟷ 2015 | 2015 ⟷ Today |
| **Fluoropolymers*** | 1940 - 60 years - 2000 | 2000 - 15 years - 2015 | 2015 | Very limited country / sector regulation | → |

The "compelling" evidence phase provides a window of opportunity for substitution

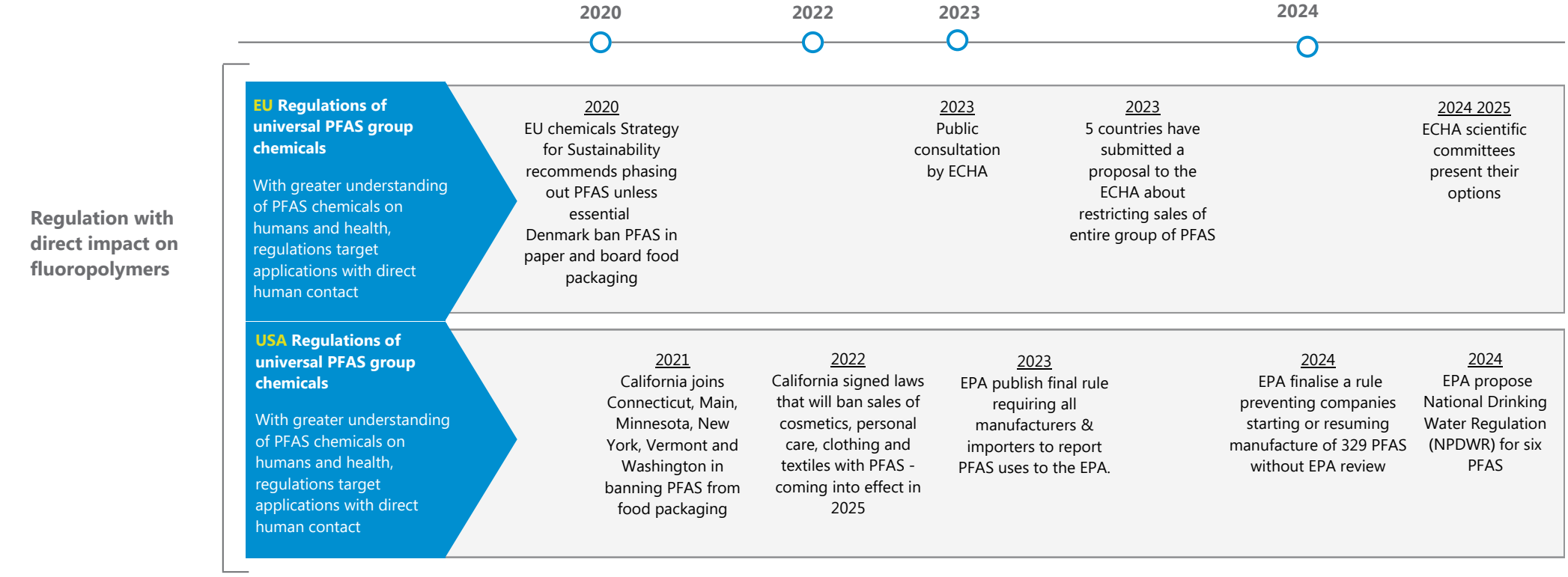
Note: *Fluoropolymers is an accelerated path to regulation due to close proximity well studied long-chain PFAS chemicals e.g. PFOS and PFOA. Source EPA: NOAA, Mesothelioma Hub.

# REGULATORY DRIVERS

## Fluoropolymers: PFOS and PFOA have been under increasing regulation in both the US and Europe with scope starting to expand to the PFAS group




**Regulation with direct impact on fluoropolymers**

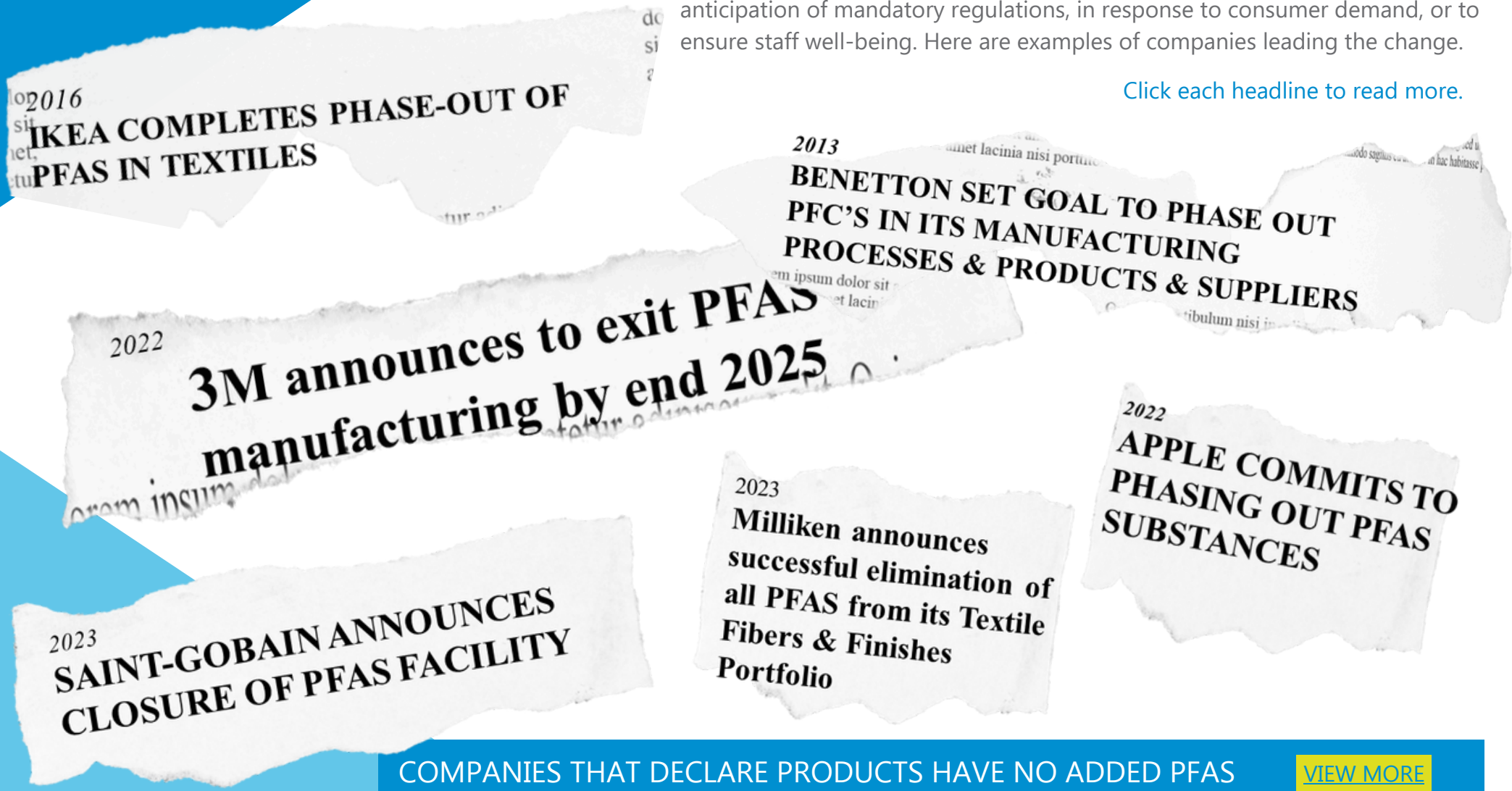



Source ECHA, EPA, Chemical & Engineering News, Chemsec: PFAS free project, EPA (Environmental Protection Agency)

# INNOVATORS OUTPACING REGULATORY REQUIREMENTS

Many organisations are already preparing for a PFAS-free future, whether in anticipation of mandatory regulations, in response to consumer demand, or to ensure staff well-being. Here are examples of companies leading the change.

Click each headline to read more.



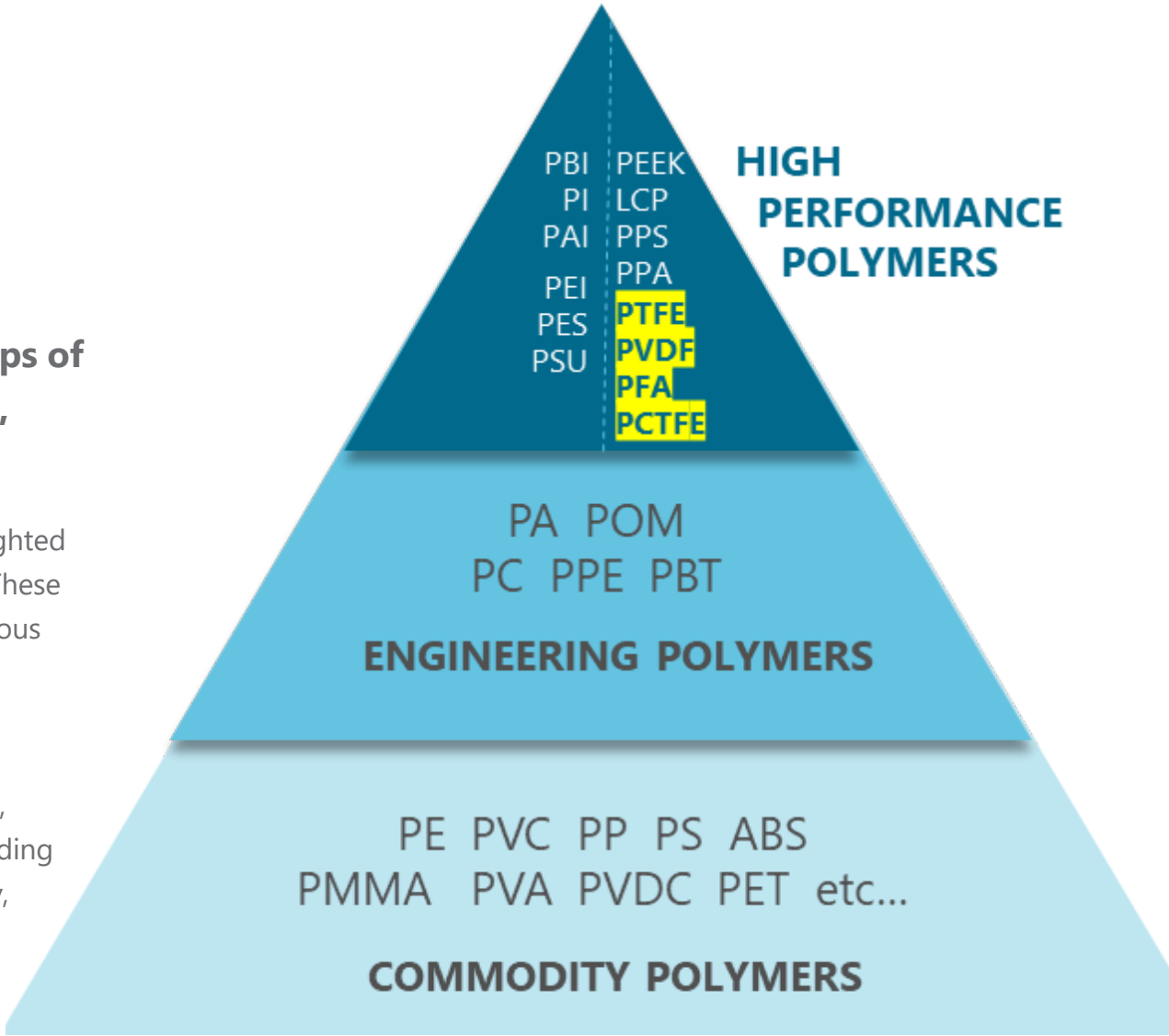

COMPANIES THAT DECLARE PRODUCTS HAVE NO ADDED PFAS VIEW MORE

# POLYMER PYRAMID

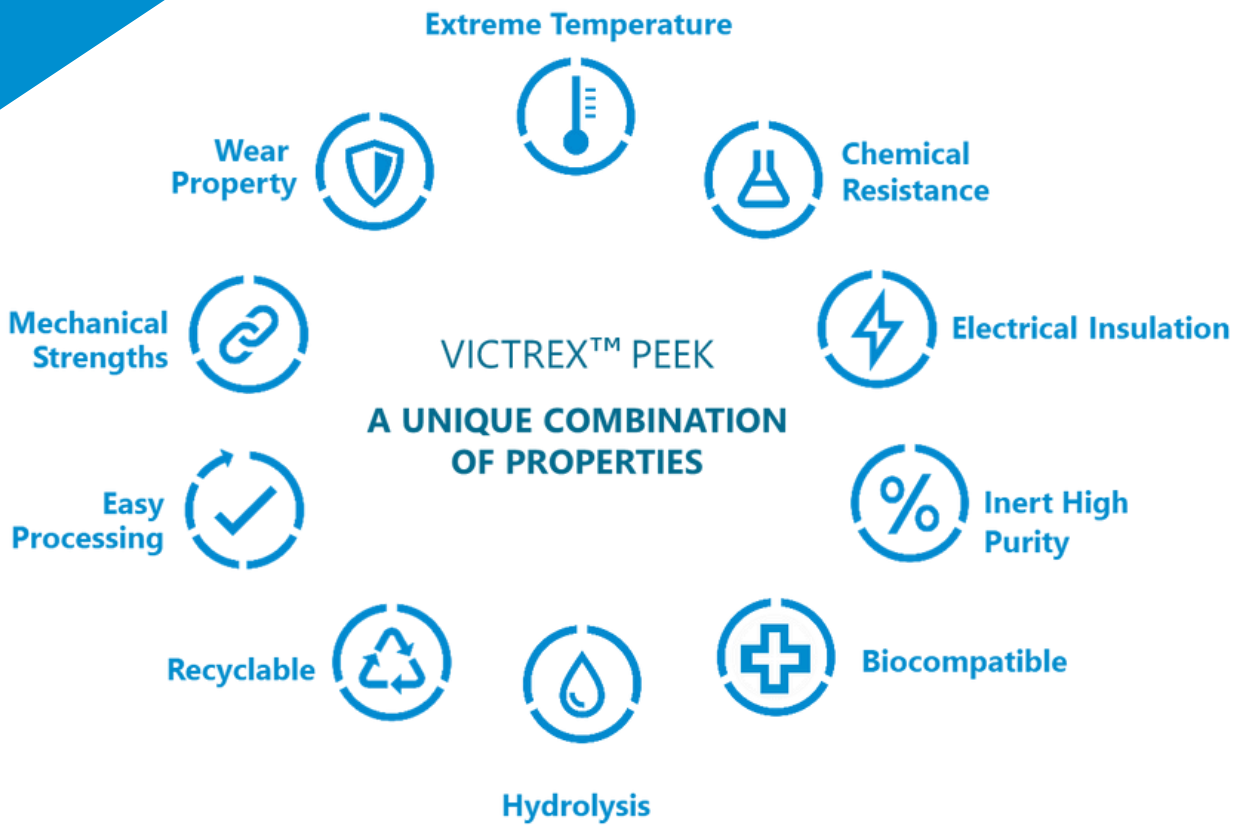
**Polymers are divided into three distinct groups of categories, based on performance properties, operating temperatures and cost.**

High performance polymers, including several PFAS highlighted in yellow, are located at the top of the polymer pyramid. These polymers are popular because of their range of advantageous properties which meet multiple engineering requirements simultaneously.

Thermal stability at high temperatures, chemical resistance, strength and durability makes them ideal for many demanding applications. These include aerospace, automotive, energy, electronics, industrial and medical applications.



# VICTREX™ PEEK POLYMERS




**Like PTFE, PVDF, PFA and PCTFE, VICTREX PEEK is also in the category of high performance polymers.**

PEEK is being used as alternative in cases where properties offered by e.g. PTFE are required such as bio-compatibility, chemical, temperature and electrical resistance, self-lubricating wear resistance.

PEEK is additionally stronger and stiffer which means it can perform additional structural roles. Although PEEK can replace PTFE in many scenarios, sometimes the increased strength and stiffness may not be required.

PEEK is not classified as a PFAS, nor are PFOAs or PFAS used in the polymerisation process.

# VICTREX PEEK POLYMER PROPERTIES VS. PTFE

| | VICTREX™ PEEK | PTFE |
|---|---|---|
| **PHYSICAL PROPERTIES** | | |
| Halogen free | Yes | No |
| Colour | Beige | White |
| Chemical resistance | Excellent | Excellent |
| Specific Gravity | 1.3 | 2.16 |
| Biocompatiblity | Yes | Yes |
| Smoke Toxicity | Low | High |
| Flammability | Excellent | Excellent |
| | | |
| **MECHANICAL & THERMAL PERFORMANCE** | | |
| Tensile strength | High | Low |
| Tensile modulus | High | Low |
| Melting temperature | 343°C | 335°C |
| | | |
| **PROCESSABILITY** | Excellent | Poor to Fair |

FOR COMPARISONS TO OTHER PFAS MATERIALS
OR SPECIFIC PROPERTY MEASURES OR REQUIREMENTS

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# POTENTIAL APPLICATION AREAS FOR PEEK AS A PFAS REPLACEMENT

## FOOD & WATER CONTACT

VICTREX FG™ grades are compliant with major food regulations and support multiple requirements for safety, quality and regulatory compliance of the industry.

**Applications**: Conveyor systems, aseptic processing, Clean-in-place (CIP) equipment, beverage dispensers, cookware,

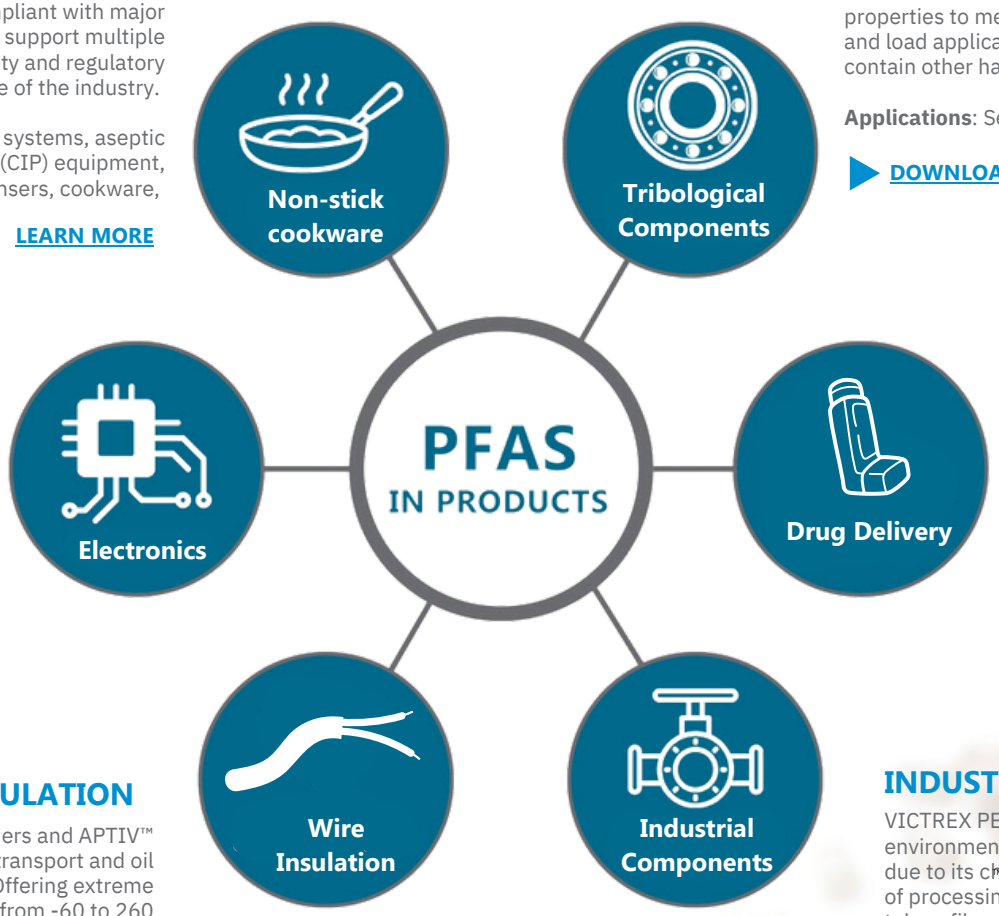
LEARN MORE

## TRIBOLOGICAL

VICTREX WG™ 101 Polymers, provide premium wear properties to meet the requirements for wear at high speeds and load application performance. PFAS-free and does not contain other halogenated additives or talc.

**Applications**: Seals, bearings, gears, gaskets, piston rings.

DOWNLOAD BROCHURE




## ELECTRONICS

Victrex PEEK polymers and APTIV™ PEEK film are chosen for electronic applications due to superior dielectric properties, high-temperature stability, and exceptional chemical resistance, ensuring reliable performance and longevity in demanding environments.

**Applications**: Consumer electronics mobile devices, 5G/ 6G base stations, phone hardware, semicon manufacture

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## DRUG DELIVERY & PHARMACEUTICAL CONTACT

VICTREX PC™ grades provide non-implantable, medical grade PEEK solutions that are supported by appropriate bio-compatibility testing, including USP 661 and USP Class VI.

**Applications**: Inhalers, injectable and wearable devices, purification, analytical & diagnostic equipment.

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## WIRE INSULATION

VICTREX PEEK Polymers and APTIV™ PEEK film are ideal for tough transport and oil and gas applications. Offering extreme temperature endurance from -60 to 260 degrees C, flame retardant, low smoke toxicity, and with different colors for identification.

**Applications**: Power cables, electric heating cables, electric coaxial cables, hook-up wires

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## INDUSTRIAL COMPONENTS

VICTREX PEEK is used in chemical and fluid handling environments and is replacing PTFE, PCTFE, PVDF, etc. due to its chemical and temperature resistance and ease of processing. Available in various forms e.g. granules, tubes, fibres and coatings. For cryogenic applications VICTREX CT 100 is a viable alternative to PCTFE.

**Applications**: Seals, connectors, tubing, filtration, composite pipe.

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# DO VICTREX PEEK PRODUCTS CONTAIN PFAS?

PFAS (Per- and polyfluoroalkyl substances) have not been intentionally added, used, or generated as by-products in the manufacturing process of unfilled Victrex PEEK and PAEK polymers. In addition, independent third-party laboratory analysis on representative product samples has confirmed that Perfluoroalkyl substances (including PFOA, PFHxS, PFCA's C9-C14) are not detectable in Victrex products down to test detection limits.

A small number of Victrex products contain PTFE (a fluoropolymer, part of the PFAS family of substances) as an additive – these are manufactured by third party companies which comply with the PFOA restrictions of the POPs regulation (EU 2019/1021). These include VICTREX PEEK grades: 150FC, 150FW, 450FC, 450FE, J301; VICTREX CTTM 200 MIC.

LEARN MORE ABOUT VICTREX PEEK GRADES THAT ARE PFAS-FREE

LEARN MORE

# VICTREX PEEK PRODUCT PORTFOLIO

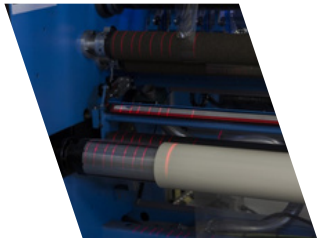
## *Performance by design*

Victrex was the first company to commercialise PEEK and has focused on developing high-performance polymeric solutions for over 40 years.  This dedication provides us with unmatched expertise and experience. By working together, we can help turn the toughest challenges into opportunities.

### VICTREX PEEK

VICTREX PEEK is THE metal replacement material that can enable optimum performance. Optimise the designs if your next-generation components to achieve significant weight savings with our vast portfolio of polymers.

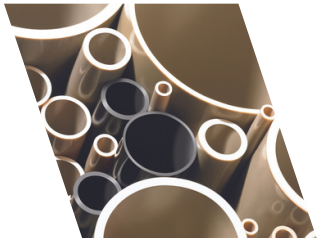
- 70% lighter vs. steel
  55% lighter vs. titanium
  40% lighter vs. aluminum
- Injection molding unfilled, carbon-fiber reinforced, and glass-filled grades.
- Proprietary grades available to achieve thinner wall sections, higher modulus, and minimal wear.



### APTIV FILM

Takes advantage of the properties of VICTREX PEEK in a thin film format. By offering unmatched processing opportunities, APTIV film allows for the design of durable, light-weight solutions.

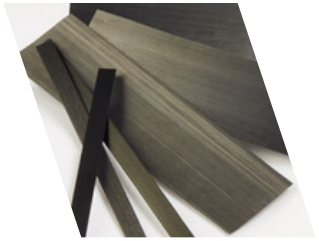
- Up to 60% lighter vs polyvinyl fluoride (PVF) film.
- Laminate, seal, weld, metalize, and many more.
- Available in thicknesses from 5 to 750 microns.



### VICTREX PIPES

Lightweight tubing manufactured from VICTREX PEEK polymer can be used for protective sheathing, cable conduits and low pressure fluid transport systems. Benefit from the ability to customer design tubing systems to fit your spacing requirements.

- 60% lighter vs. stainless steel
  45% lighter vs. titanium
  33% lighter vs. aluminum
- Bend, form, fit, flare and clamp
- Excellent corrosion resistance and fire, smoke and toxicity properties.



### POLYMERS FOR COMPOSITES

Combine strength and light weight by specifying VICTREX PEEK as a composite matrix material. This innovative technology allows engineers to design for the most demanding environments.

- Up to 70% lighter than metal alloys
- 5x higher specific strength
  4x higher fatigue strength
  4x higher specific stiffness vs. aluminum
- Available in braid, fabric, flake, long fiber pellets, tow and unidirectional tape and sheet

### VICOTE COATINGS

Durable VICTREX PEEK coatings enhance the lifetime of metal substrates while being friendly to the environment. Enhance the performance of your components with Victrex liquid and powder dispersions.

- Use a one-coat system for a smooth, uniform surface
- Excellent resistance to wear, abrasion, high heat, creep and chemicals.
- Halogen-free with no additives

NEED HELP SELECTING PRODUCTS?

CONTACT US

# WHY VICTREX?

From the commercialisation of PEEK over 40 years ago, Victrex has continually pioneered new PAEK-based polymer solutions that have transformed markets, delivering global impact in the toughest environments. Our commitment to innovation, quality and customer satisfaction are among the reasons we're trusted and are chosen by customers and have been for decades.

- Accelerating customer innovation and speed to market
- Supporting customers from concept through to commercialisation
- Security of supply with PEEK and PAEK dedicated R&D and manufacturing facilities
- Global network of Technical Support experts
- Strong ESG credentials with SBTi approved decarbonisation targets

"Partnering for success", hear from Michael Koch, Victrex Sustainable Solutions Managing Director (2 mins)

CLICK TO WATCH

#1 PEEK EXPERT

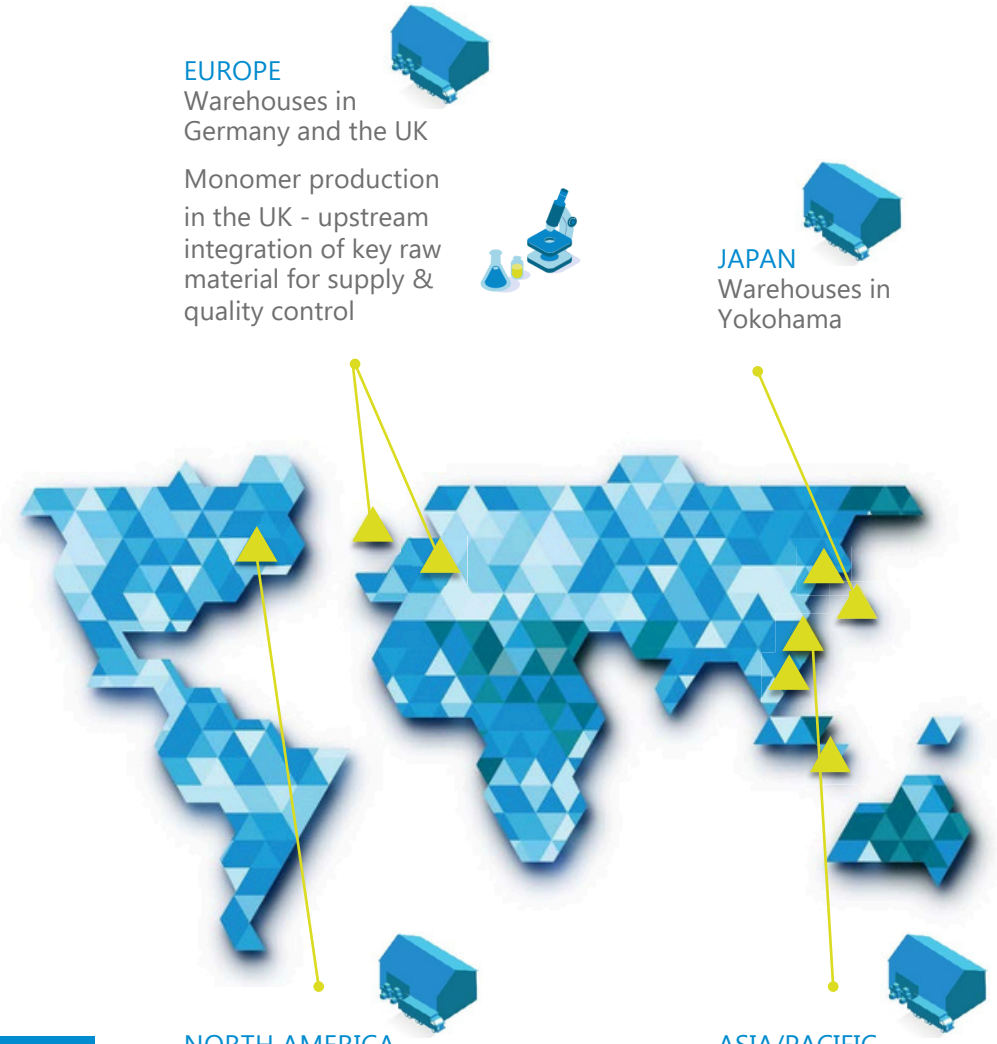
40+ YEARS OF EXPERIENCE

# ENABLING SECURITY OF SUPPLY

- Upstream integration enabling control of formulating flexibility & supply
- Global facilities offering short lead times and strengthening overall logistics
- Strategic commitment to supply chain security supported through Class A certified Integrated Business Planning
- #1 global PEEK production capacity with invested and ready for growth now

**'Ensuring Security of Supply' - a 2 minute video**

CLICK TO WATCH



**In the face of the PFAS concerns, we take pride in offering a range of proven high-performance PEEK polymers as potential safer and more sustainable alternatives.**

Contact us to discuss whether PEEK could be a suitable PFAS alternative for your application.

**CONTACT OUR PEEK EXPERTS**

victrex

## Follow us on social media!

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