Throwaway Packaging, Forever Chemicals

European wide survey of PFAS in disposable food packaging and tableware

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ARNIKA · BUND · IPEN for a toxics-free future · CHEMTrust · HEAL Health and Environment Alliance · Tegen Gif · ClientEarth · Forbrugerrådet Tænk Danish Consumer Council · générations futures

This project is a joint collaborative of the following organizations:

Arnika Association (Czech Republic) is a non-governmental organisation established in 2001. Its mission is to protect the nature and healthy environment for future generations both at home and abroad. Since the beginning Arnika has been working on protection of consumers from chemically hazardous products. Lately, Arnika has been making own research focusing on persistent organic chemicals in products. Arnika serves as a regional hub for Central, Eastern and Western Europe for IPEN. www.arnika.org

CHEM Trust is a collaboration between CHEM Trust, a UK registered Charity and CHEM Trust Europe eV, a charity based in Germany. Our overarching aim is to prevent synthetic chemicals from causing long term damage to wildlife or humans. CHEM Trust's particular concerns are endocrine disrupting chemicals, persistent chemicals, the cocktail effect of chemicals and the role of chemical exposures in the early life of wildlife and humans. CHEM Trust engages with scientific, environmental, medical and policy communities to improve the dialogue concerning the role of adverse effects of chemicals in wildlife and humans and to harness a wide coalition to drive improved chemicals policy and regulation. CHEM Trust UK Charity Register Number: 1118182; EU Transparency Register Number: 27053044762-72. chemtrust.org

BUND/Friend of the Earth Germany is an association for environmental protection and nature conservation aimed at bringing about sustainable development on a local, regional, national and international level. We are a member-based association with democratic decision-making structures on all levels, within which elected voluntary officials have the final say on goals, strategies and use of the association's resources. We develop long-term strategies and solutions, set goals aimed at protecting the environment and nature, and demonstrate through the realization of individual projects that sustainability can be put into everyday practice in our society. www.bund.net

Danish Consumer Council (Denmark) is an independent consumer organisation created in 1947 which works for the promotion of sustainable and socially responsible consumption. We defend consumer rights and make consumers a power in the market.Through chemical testing and communication to consumers the initiative Danish Consumer Council Think Chemicals specifically helps consumers avoid problematic chemicals when shopping. www.kemi.taenk.dk

The Health and Environment Alliance (HEAL) (Belgium) is the leading not-for-profit organisation addressing how the environment affects human health in the European Union (EU) and beyond. HEAL works to shape laws and policies that promote planetary and human health and protect those most affected by pollution, and raise awareness on the benefits of environmental action for health. HEAL's EU Transparency Register Number: 00723343929-96. www.env-health.org

Tegengif - Erase all Toxins(The Netherlands) is a not-for-profit organisation based in Amsterdam. Our aim is a non-toxic living environment. We raise public awareness of consumers' daily exposure to toxic chemicals via appealing research, campaigning and policy influencing. We believe growing awareness will both stimulate the demand for toxin-free products and increase public support for regulations for a toxin-free world. https://www.erasealltoxins.org

Générations Futures (France) has been campaigning on pesticides related topics in France for over 25 years. It has become the reference specialized NGO in France on this issue. GF has a unique expertise on pesticides and health campaigning in France and a strong track record of reaching out to grassroots organizations and the public, as well as to national and European policy-makers and the media. GF extended its activities to other categories of chemicals with a new campaign named 'Desintox'. Its various activities include surveys, conferences, product testing, legal actions and publication of reports to raise awareness among the public and decision makers. www.generations-futures.fr/

IPEN. Established in 1998, **International Pollutants Elimination Network (IPEN)** is currently comprised of over 600 Participating Organisations in primarily developing and transition countries. IPEN brings together leading environmental and public health groups around the world to establish and implement safe chemicals policies and practices that protect human health and the environment. IPEN's mission is a toxics-free future for all. www.ipen.org

EXECUTIVE SUMMARY

‘Forever chemicals’ in disposable food packaging and tableware: a study in 6 European countries and an overview of the implications of PFAS exposure for our health and our environment.

This report is based on a European study, carried out by 8 civil society organisations, into the presence of per- and polyfluoroalkyl substances (PFAS) in paper, board and moulded plant fibre disposable food packaging and tableware, sold in six European countries: The Czech Republic, Denmark, France, Germany, the Netherlands and the United Kingdom.

The aim of this study was to collect evidence on the widespread use of PFAS in disposable food packaging and tableware in Europe, as well as to uncover levels of background (i.e., unintentional) contamination with PFAS chemicals in such products.

MAIN FINDINGS

- **PFAS are widely used in disposable food packaging and tableware in Europe.** This includes food packaging from popular fast-food chains and restaurants.
- **Traces of PFAS were detected in all samples selected for lab analysis** demonstrating the pervasive contamination of both production and supply chains for paper and board food packaging with PFAS chemicals.
- **In some samples, the total organic fluorine (TOF) levels measured were up to 60 times higher than the indicator value set by the Danish Veterinary and Food Administration** to help companies assess whether organic fluorinated substances have been added to paper and board food packaging or not.
- **Intentional PFAS treatment was confirmed in 32 out of the 42 samples sent to the laboratory for analysis.**
- **Less than 1% of the total organic fluorine present in the PFAS-treated samples could be assigned to specific PFAS chemicals identified via targeted analysis. This means that over 99% of the total PFAS load remains unidentified.** This is of great concern, because we know that all PFAS persist in the environment, that exposure to certain PFAS chemicals can have harmful health effects, and that some can migrate from the packaging into the food.
- Our results also indicated that the **PFAS present in some of the food packaging samples tested had the potential to impair thyroid activity.**
- The **highest PFAS concentrations** were consistently found in **moulded fibre products**, (e.g. bowls, plates, and food boxes) advertised as **biodegradable or compostable disposable products.**
- **In Denmark, where the use of PFAS in paper and board food packaging has been banned since July 2020, none of the sampled french fries bags from McDonald's, for example, exhibited any PFAS treatment**. This is in contrast to the results for the same items sampled in the Czech Republic and the United Kingdom. These findings illustrate that **regulations are an effective tool to protect people from exposure to harmful chemicals and to push industry players to find safe replacements. However, this also highlights the lack of EU-wide harmonised regulation and protection when it comes to food contact materials.**
- Because PFAS are very persistent, their widespread presence in disposable food packaging produced in very high volumes, that also by definition have a very high turnover rate, is **of great concern in terms of PFAS accumulation in our environment**. This in turn can **endanger human health and wildlife** in the long term and hinder the achievement of a **clean and circular economy**.

Overall, the findings of our report demonstrate the widespread use of and contamination by PFAS in disposable food packaging and tableware across Europe. These items are by definition and design meant to be used for very short durations before being thrown away. This contrasts with the extreme persistence of all PFAS chemicals. Alternatives to PFAS treatments do exist, and even more importantly, safe, durable and reusable options for food containers and tableware are already widely available. Therefore, the treatment of disposable items with PFAS is a typical example of completely unnecessary and avoidable chemical uses that run counter to achieving a clean circular economy. It is high time that national governments and European institutions phase out all such uses of PFAS and manage these substances as a group.

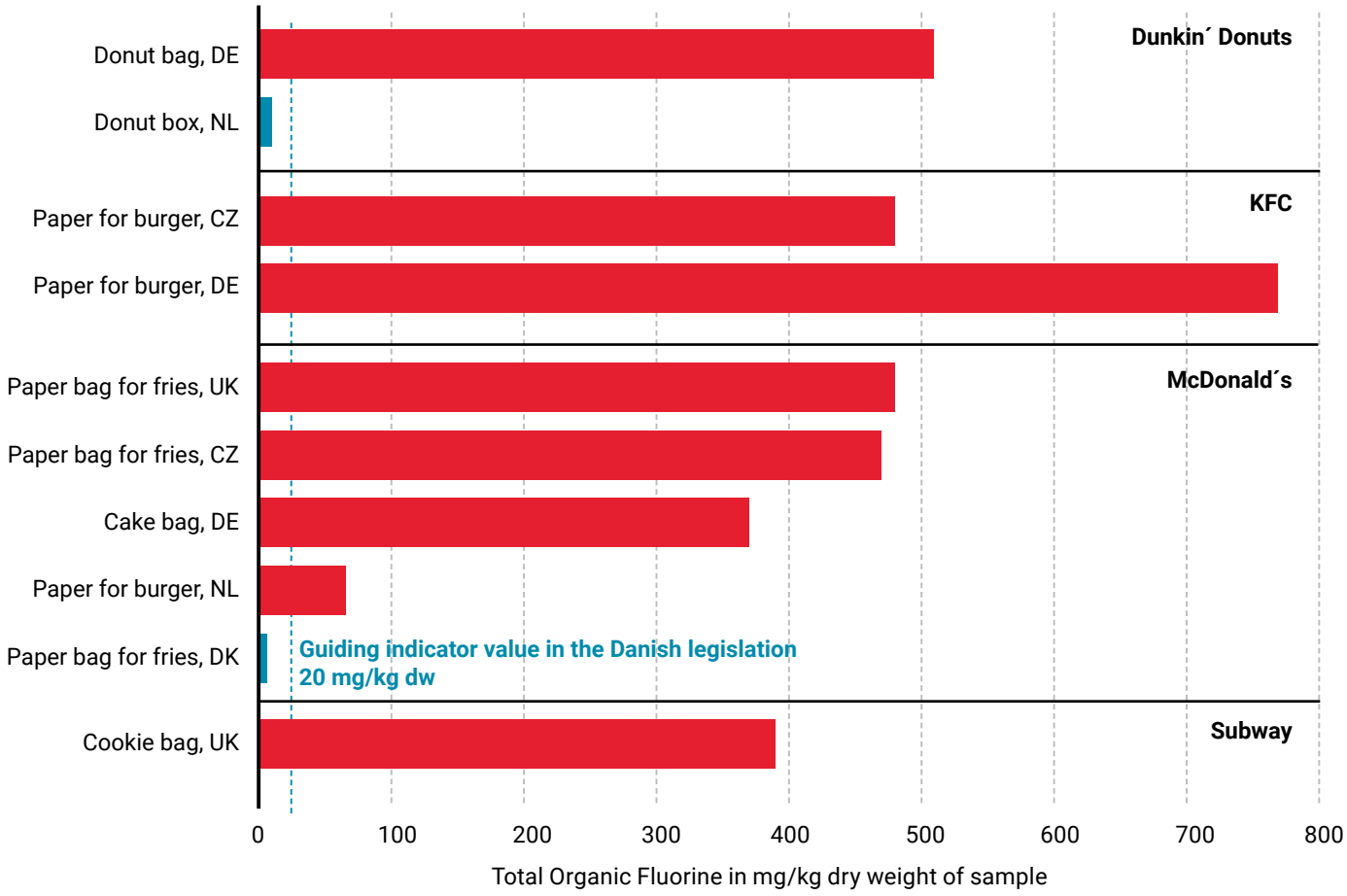
HEALTH AND ENVIRONMENT CONCERNS ABOUT PFAS

PFAS is a large family of over 4,500 compounds [1], also known as *"Forever Chemicals"* due to their extreme persistence in the environment. They are used in a wide variety of consumer products and industrial applications [2], including food packaging, where their ability to repel both grease and water have been considered highly convenient.

However, PFAS are giving rise to increasing concern due to their impacts on health and our environment. PFAS do not degrade easily in the environment. They are mobile, can travel long distances and are already causing water contamination problems across Europe [3]. **Some PFAS emitted today could still be present in the environment in a century, representing a threat for both current and future generations. This raises legitimate questions about their multiple consumer and industrial uses, including their use in disposable products such as fast food packaging and tableware.**

Scientific studies have associated exposure to a number of PFAS with severe adverse health effects, including cancer, and impacts on the immune, reproductive and hormone systems, as well as with a reduced response to vaccinations [4, 5]. In the context of food packaging, studies have shown that PFAS can migrate from the packaging into the food [6], adding to the overall PFAS exposure of the general population. The more we learn about these chemicals, the more reason there is for concern, and the more urgent it becomes to minimise emissions and exposure. By way of illustration, between 2008 and 2020, **the European Food Safety Authority lowered the recommended safe levels of exposure to some PFAS by more than 99% [7, 8].**

Total Organic Fluorine content of takeaway food packaging from global fast-food chains.



Only a few compounds of the large PFAS family have been restricted at the global, regional and/or national levels, but thousands more exist and are available for use. In the context of food contact applications, Denmark is currently the only country that has banned PFAS for use in food packaging [9]. Also, the industry strategy has been to just replace banned, widely used PFAS with others - usually less studied - for industrial applications and/or uses in consumer products [10].

BACKGROUND AND METHODOLOGY

In a collective effort of eight non-profit organisations, and under the supervision of the Czech organisation Arnika, 99 samples of disposable food packaging and tableware made of paper, board and moulded plant fibre were purchased in six different countries between May and December 2020 (e.g., sandwich and bakery bags, take-away food boxes). **The sampling targeted popular fast-food chains and takeaway restaurants, as well as supermarkets. Moulded plant fibre tableware was purchased via online stores**. The latter products are advertised as compostable and are increasingly being used in takeaway restaurants as an alternative to plastic containers.

In order to inform the selection of packaging samples for chemical analysis, the samples were first screened using a simple oil beading test [11]. This test indicates if a sample material is oil repellent, a characteristic of packaging that has been treated with PFAS. **28 oil-beading samples, likely candidates for intentional PFAS treatment, were selected for chemical analysis. 14 samples showing no oil-repellent properties were also selected to assess the level of background contamination in food packaging products**.

All 42 selected samples were analysed by an accredited laboratory for their Total Organic Fluorine (TOF) content, an accepted proxy for total PFAS content. The TOF values were compared to the TOF guiding indicator value set up by the Danish Veterinary and Food Administration to help companies assess whether organic fluorinated substances have been added to paper and board food packaging [9]. **The 42 samples were also sent to an independent laboratory for targeted analysis of 55 individual PFAS** in order to seek more information regarding the specific nature of the PFAS present in the samples. Furthermore, **17 samples were selected for investigation of any disruption of thyroid activity as a potential unintended health effect of PFAS exposure [12].**

WIDESPREAD USE OF PFAS IN FOOD PACKAGING IN EUROPE RAISES CONCERN FOR HUMAN HEALTH AND THE ENVIRONMENT

The results from this study clearly show that the use of PFAS in disposable food packaging and tableware is a widespread practice across Europe.

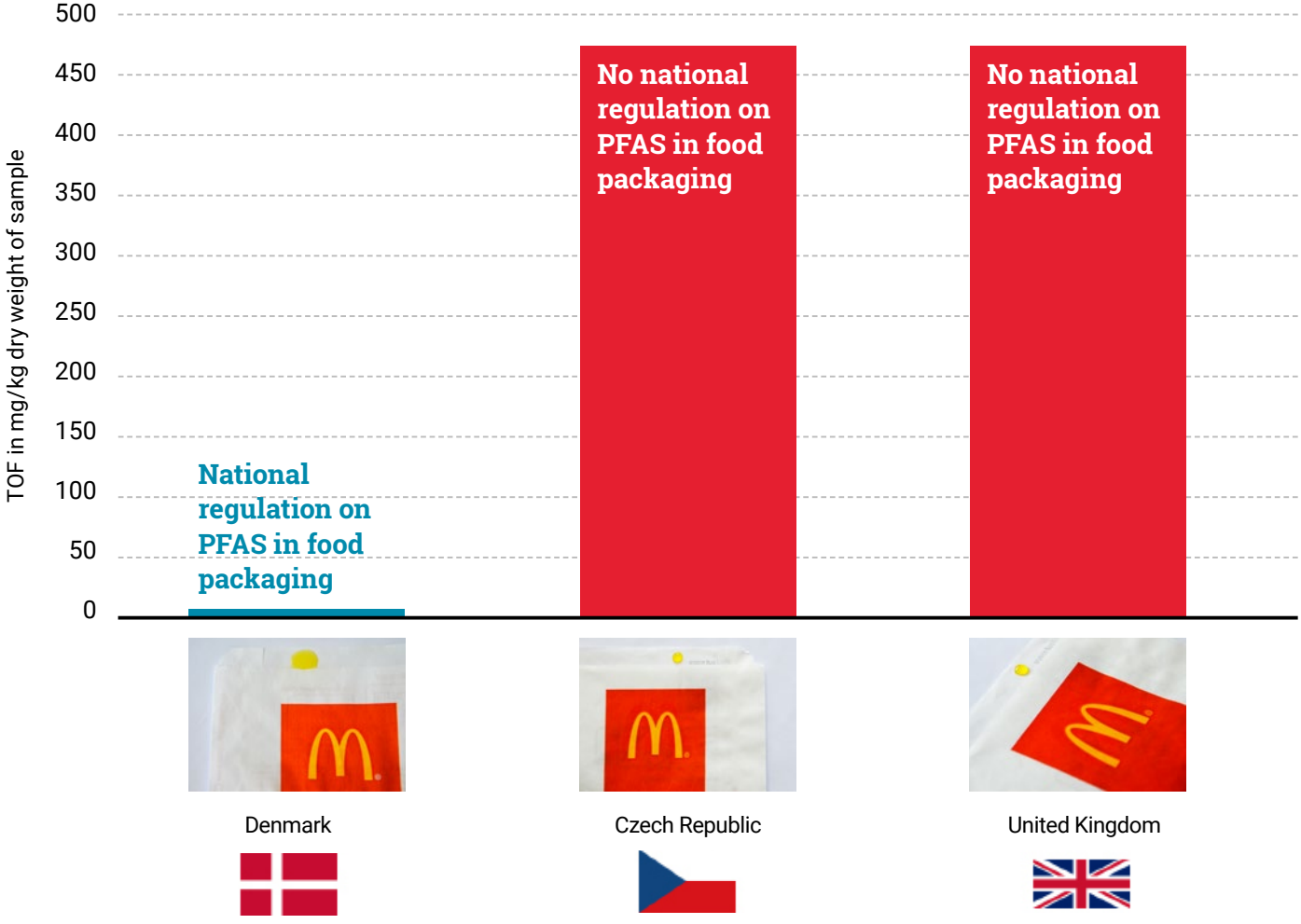
32 samples, covering every country surveyed, indicate the use of intentional PFAS treatments according to the Danish Veterinary and Food Administration indicator value for Total Organic Fluorine (TOF) [9]. In some cases, **the TOF levels were up to 60 times higher than the indicator value.**

The **highest concentrations were consistently found in moulded fibre products**, such as bowls, plates, and food boxes **advertised as biodegradable or compostable** disposable products. However, the presence of non-degradable PFAS chemicals clearly contradicts this claim and this loophole should urgently be addressed.

Less than 1% of the total organic fluorine present in the PFAS-treated samples could be assigned to specific PFAS chemicals identified via targeted analysis. This means that over 99% of the total PFAS load remains unidentified. However, the PFAS chemicals that could be identified **are frequently associated with PFAS treatments involving side-chain fluorinated polymers [13].**

Even though less than 1% of the PFAS present in the samples tested could be identified, **the nature of the PFAS identified is already in itself enough to be a source of concern for human health.** The PFAS chemicals identified have been found to migrate from the food packaging into the food, and are associated with adverse health effects such as cancer, liver toxicity, and impacts on the reproductive and hormonal systems [14]. Our ecotoxicity test showed that the PFAS present in some of the food packaging samples tested had the potential to impair thyroid activity. **Their presence in food packaging is a source of repeated exposure for people frequently visiting and eating food from fast-food chains and takeaway restaurants.** The 1% of PFAS that could be identified is, however, only the tip of the iceberg in terms of potential migration into food and impacts for consumers in the long term. Despite not being identified individually, the other 99% of

Total organic fluorine (TOF) content in french fries bags from McDonald's bought in three different countries in 2020



PFAS present cause concern due to their ability to persist and accumulate in the environment.

By definition and design, disposable food packaging and tableware are intended to be used only once and then thrown away after the food has been consumed. **They are produced in high volumes and have very high turnover rates.** PFAS can be emitted into the environment at every stage of these items' life cycle, from production to disposal [15]. **This contributes to the buildup of these highly persistent chemicals in the environment, and to continuous human and wildlife exposure, via the contamination of the food chain and the drinking water.**

PFAS-FREE ALTERNATIVES EXIST AND REGULATION IS A STRONG INCENTIVE FOR COMPANIES TO MOVE AWAY FROM PFAS

Alternatives to PFAS-treated takeaway packaging exist and are available on the market as shown by our results, including disposable paper and board packaging for takeaway food (e.g., sandwich and fries bags, and cardboard bakery and pizza boxes). Durable and reusable alternatives to moulded fibre tableware are also largely available for consumers, restaurants and retailers.

Where regulation has been put in place, it has worked effectively to incentivise companies to move away from the use of PFAS. In Denmark, the use of PFAS in paper and board food packaging has been banned since July 2020 [9]. Our study found that none of the sampled McDonald's french fries bags bought in Denmark exhibited PFAS treatment, whereas intentional PFAS treatment was found for the same items bought in the Czech Republic and the United Kingdom. **This shows that regulation can and does have an impact to protect people from exposure to harmful chemicals and drive companies to produce safe replacements. In Denmark, McDonald's has been able to replace PFAS-treated packaging and comply with the regulation. However, this finding also highlights the lack of EU-wide harmonised regulations for food contact materials, which results in different levels of protection across countries.**

PFAS, A THREAT TO A CLEAN AND SAFE CIRCULAR ECONOMY

It is clear from our study that unintentional PFAS contamination in food packaging challenges the achievement of a clean recycling chain and circular economy. All of the lab-analysed food packaging samples that were not intentionally treated with PFAS were still contaminated with PFAS chemicals. The contamination levels sometimes exceed the indicator value to measure background contamination set up by the Danish authorities [9].This highlights the pervasive contamination of the food packaging production and supply chain with PFAS chemicals. PFAS contamination could take place at the production stage due to the use of PFAS-containing printing inks, or during recycling of PFAS-treated paper and board [16], as several of the samples tested are indicated as containing recycled material. PFAS contamination throughout the production and recycling chains is a problem that needs fixing. This must be addressed by avoiding PFAS at all stages of the supply chain and throughout the life cycle of products.

RECOMMENDATIONS TO REVERSE THE TREND AND PROTECT PEOPLE AND WILDLIFE FROM PFAS EXPOSURE

Our findings illustrate the all-pervasive presence of harmful PFAS chemicals in our daily environments through the example of a specific type of consumer product casually used and discarded by people within a few minutes. Even when no intentional PFAS treatment has been applied, these disposable products are contaminated with these highly persistent chemicals.

It is not only challenging to identify individual PFAS that are being used for specific food contact applications, but also to control them once they are in the environment as a consequence of this use. Overall, this points to the urgent need to drastically change the regulatory approach to PFAS in order to:

> prevent emissions of all PFAS chemicals,
> stop the accumulation of these highly persistent chemicals in the environment and our bodies,
> and protect people and wildlife from exposure to these harmful substances.

It is high time to prioritise preventing emissions by stopping the use of PFAS for all applications that are not necessary for the health, safety and the functioning of society. Their use in disposable food packaging and tableware is one example of such unnecessary uses.

BASED ON THE RESULTS OF THIS STUDY, WE CALL ON:

> **The five European countries (Denmark, Germany, Norway, Sweden, The Netherlands)** currently developing the European restriction on all non-essential uses of PFAS to include the full range of PFAS chemicals in the restriction, including fluorinated polymers, and to guarantee that disposable food packaging and tableware is covered within its scope.

> **The European Commission**:

As part of its commitments under the Chemicals Strategy for Sustainability

- To support the development of the restriction mentioned above.
- To proceed with the development of the criteria for essential/non-essential uses for chemicals management.
- To proceed with the development of the criteria for Safe and Sustainable by Design chemicals, including to prevent the use of highly persistent chemicals such as PFAS in high turnover disposable and compostable products.

In view of the upcoming reform of the Food Contact Materials legislation:

- To introduce harmonised rules for all materials used for food contact (including paper, board, and moulded plant fibres) in order to guarantee that citizens are evenly protected against the presence of hazardous chemicals in food contact materials and articles.

> **National governments:**

- **In the European Union:** to support the development of a broad-scoped and protective restriction on all non-essential uses of PFAS and thereafter to fully implement it.
- **Worldwide:** to develop similar restrictions.

> **Parties to the Stockholm and Basel Conventions:**

- To work for a class-based approach of listing all PFAS for global elimination under the Stockholm Convention.
- To work for a class-based approach of defining a “low POPs content” level for POPs waste containing PFAS.

> **Companies**

- To commit to phasing out PFAS in their products without waiting for specific regulations to enter into force and join the ChemSec-led ‘No to PFAS’ corporate movement.

> **Citizens:**

- To ask that your national governments support the European move to phase out all non-essential uses of PFAS chemicals, and urge companies to phase out PFAS from the products sold in your countries.
- To bring your own reusable food containers when you visit fast-food chains and takeaway restaurants in order to avoid paper, board and moulded fibre food packaging that could be treated with PFAS chemicals.
- To spread the word on social media - using the #BanPFAS hashtag - to increase public pressure for a phase-out of PFAS chemicals.

References (executive summary)

1. OECD, *Toward a new comprehensive global database of per- and polyfluoroalkyl substances (PFASs): Summary report on updating the OECD 2007 list of per- and polyfluoroalkyl substances (PFASs). Joint meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology*, in *Series on Risk ManagementNo. 39*. 2018, Environment Directorate. p. 24.

2. Glüge, J., et al., *An overview of the uses of per- and polyfluoroalkyl substances (PFAS)*. Environmental Science: Processes & Impacts, 2020. 22(12): p. 2345-2373.

3. Goldenman, G., et al., *The cost of inaction. A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS*, in *TemaNord 2019:516*. 2019, Nordic Council of Ministers. p. 194.

4. IPEN, Endocrine Society, *Plastics, EDCs & Health: A Guide for Public Interest Organizations and Policymakers on Endocrine Disrupting Chemicals & Plastics*. 2020. p. 91.

5. European Environmental Agency, *Emerging chemical risks in Europe — 'PFAS'*. 2019.

6. Zabaleta, I., et al., *Occurrence of per- and polyfluorinated compounds in paper and board packaging materials and migration to food simulants and foodstuffs.* Food Chem, 2020. **321**: p. 126-746.

7. EFSA, *Perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and their salts. Scientific Opinion of the Panel on Contaminants in the Food chain.* 2008.

8. Schrenk, D., et al., *Risk to human health related to the presence of perfluoroalkyl substances in food.* EFSA J, 2020. **18**(9): p. e06223.

9. Ministry of Environment and Food of Denmark, Danish Veterinary and Food Administration, *Ban on fluorinated substances in paper and board food contact materials (FCM)*. 2020.

10. Wang, Z., et al., *A Never-Ending Story of Per- and Polyfluoroalkyl Substances (PFASs)?* Environ Sci Technol, 2017. **51**(5): p. 2508-2518.

11. Dinsmore, K.J., *Forever chemicals in the food aisle: PFAS content of UK supermarket and takeaway food packaging*. 2020, Fidra: United Kingdom. p. 24.

12. Ouyang, X., et al., *Miniaturization of a transthyretin binding assay using a fluorescent probe for high throughput screening of thyroid hormone disruption in environmental samples.* Chemosphere, 2017. **171**: p. 722-728.

13. Washington State Department of Ecology, *Per- and Polyfluoroalkyl Substances in Food Packaging Alternatives Assessment*, in *Hazardous Waste and Toxics Reduction Program*. 2021. Olympia, Washington. p. 2018.

14. Rice, P.A., et al., *Comparative analysis of the toxicological databases for 6:2 fluorotelomer alcohol (6:2 FTOH) and perfluorohexanoic acid (PFHxA).* Food Chem Toxicol, 2020. **138**: p. 111210.

15. Schaider, L.A., et al., *Fluorinated Compounds in U.S. Fast Food Packaging.* Environ Sci Technol Lett, 2017. **4**(3): p. 105-111.

16. Trier, X., et al., *PFAS in paper and board for food contact - options for risk management of poly- and perfluorinated substances*. 2017: Copenhagen, Denmark. p. 110.

The full report is available at https://english.arnika.org/publications/throwaway-packaging-forever-chemicals-european-wide-survey-of-pfas-in-disposable-food-packaging-and-tableware

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