Toxics in Our Clothing

Forever Chemicals in Jackets and Clothing from 13 Countries

Jitka Straková • Sara Brosché • Karolína Brabcová

IPEN is a network of non-governmental organizations working in more than 100 countries to reduce and eliminate the harm to human health and the environment from toxic chemicals.
www.ipen.org

Arnika is a Czech non-profit organization that has been uniting people striving for a better environment since 2001.Its mission is to protect nature and a healthy environment for future generations both in Czechia and abroad.
www.arnika.org

Acknowledgements

IPEN, Arnika and other contributors to this report gratefully acknowledge the financial support provided by the Government of Sweden, Tides Foundation, Global Greengrants Fund and other donors that made the production of this document possible. Samples from Kenya were analyzed as part of the "Advancing a Non-Toxic Circular Economy: Reducing non-circular plastics and advancing circular plastic production, collection and recycling in Kenya" project implemented in cooperation with the Secretariat of the Basel Convention, with funding from the Norwegian Agency for Development Cooperation (Norad) as a contribution to the work programme of the Basel Convention Plastic Waste Partnership.

The views herein do not necessarily reflect the official opinion of any of the institutions providing financial support. Responsibility for the content lies entirely with IPEN and Arnika.

This report should be cited as: Straková, J., Brosché, S., Brabcová, K. et al., 2023. Toxics in our Clothing: Forever Chemicals in Jackets and Clothing from 13 Countries, 48 p.

ISBN 978-80-11-04187-8

Toxics in Our Clothing

Forever Chemicals in Jackets and Clothing from 13 Countries

Authors: Mgr. Jitka Straková[1,2], Sara Brosché, PhD.[1], Mgr. Karolína Brabcová[2]

Collaborating authors: Valeriya Grechko[2], Kristina Žulkovska[2], Barbora Skořepová[2], Joanna Sawicka[3], Yuyun Ismawati[4], Griffins Ochieng[5], Dorothy Adhiambo[5], Aron Kecha[5], Dr. Shahriar Hossain[6], Siddika Sultana[6], Khalilur Rahman[6], Subhatun Nur Prithy[6], Dr. Shantona Khatun[6], Tanjima Haque Trisha[6], Shanon Iffat Alam[6], Azra Vuković[7], Nina Mihailović[7], Jasminka Randjelovic[8], Valentina Mart[8], Annelies den Boer[9], Anna Watson[10], Julie Schneider[10], Chalani Rubesinghe[11], Hari shankar Sharma[12], Neeraj Sharma[12], Janna Kuhlmann[13], Dylan Jones[14], Mike Schade[15], Thitikorn Boontongmai[16], Nichchawan Bubphachat[16], Chutimon Thowsakul[16], Punyathorn Jeungsmarn[16]

Analytical team: prof. RNDr. Tomáš Cajthaml, Ph.D., DSc.[17], RNDr. Jaroslav Semerád, Ph.D.[18]

Proof-reading: Charles Margulis, Anna Watson, Jennifer Federico, Cristina Cotofana

Graphic design: Martin Vimr

Photographs: Markéta Šedivá and participating organizations

1. International Pollutants Elimination Network (IPEN)
2. Arnika, Czech Republic
3. Buy Responsibly Foundation, Poland
4. Nexus for Health, Environment, and Development Foundation (Nexus3), Indonesia
5. Centre for Environment Justice and Development, Kenya
6. Environment and Social Development Organization- ESDO, Bangladesh
7. Green Home, Montenegro
8. Safer Chemicals Alternative (ALHem), Serbia
9. Tegengif Erase all Toxins, Netherlands
10. CHEM Trust, United Kingdom
11. Centre for Environmental Justice, Sri Lanka
12. Gramin Vikas evam Paryavaran Sanstha, India
13. BUND, Friends of the Earth Germany
14. Alaska Community Action on Toxics (ACAT), Alaska
15. Toxics-Free Future, US
16. Ecological Alert and Recovery - Thailand (EARTH)
17. Institute for Environmental Studies, Faculty of Science, Charles University, Czech Republic
18. Institute of Microbiology of the Czech Academy of Sciences, Czech Republic

LIST OF ABBREVIATIONS

AAP - American Academy of Pediatrics
CIC - Combustion Ion Chromatography
COP9 - Ninth Session of the Conference of the Parties
diPAPs – Polyfluoroalkyl phosphoric acid diesters
DWR - Durable Water Repellent
EOF – Extractable Organic Fluorine
ECHA - European Chemicals Agency
EPA - Environmental Protection Agency
ESM - Environmentally sound management
EU - European Union
FTOHs - Fluorotelomer alcohols
HS - Harmonized System
H11 – Toxic characteristic (delayed or chronic)
KOH – Potassium hydroxide
LOD/LOQ - Level of Detection/Quantification
OECD –Organization for Economic Cooperation and Development
PFAS - Per- and polyfluoroalkyl substances
PFCAs - Perfluorinated carboxylic acids
POPs – Persistent Organic Pollutants
REACH –Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals
SVHCs – Substances of Very High Concern
TDFAs - (3,3,4,4,5,5,6,6,7,7,8,8,8- tridecafluorooctyl) silanetriol and any of its mono-, di- or tri-O-(alkyl) derivatives
TULAC - Textiles, Upholstery, Leather, Accessories and Carpentry
UK – United Kingdom
US – United States

Chemical names of PFAS targeted in lab analysis are given in Annex 1.

Table of Contents

KEY FINDINGS

- For this study, jackets and other clothing sold as water- or stain-resistant were purchased from 13 countries in Asia, Africa, Europe and North America. Most of the jackets tested were marketed for children. Countries included were Germany, Czech Republic, Netherlands, Poland, United Kingdom, Serbia, Montenegro, Kenya, Bangladesh, India, Sri Lanka, Thailand, and the U.S.

- As there are thousands of PFAS that can be used in products, two kinds of tests were performed. Samples were tested for 58 specific PFAS and for extractable organic fluorine (EOF), a measurement that correlates with the use of any PFAS.

- We tested 72 samples: 56 jackets and 16 other clothing samples. Testing showed that 46 of 72 samples (63.8%) contained PFAS or had EOF levels indicating the presence of PFAS. Out of the 56 jackets, 35 (62.5%) contained PFAS or had EOF levels indicating the presence of PFAS.

- 16 jacket samples had PFAS at levels above proposed EU limits; 13 jackets contained at least one PFAS above the limit; and another 3 jackets had levels above limits for the category of PFAS known as PFCAs.

- PFOA, a PFAS chemical that is known to be highly toxic and has been banned globally, was the most common PFAS in the products, found in 17 outdoor jackets. Another PFAS chemical, PFDA, was found in 17 samples. PFDA is restricted under EU rules and has been recommended for a global ban.

- 16 items of other clothing were tested, including aprons, T-shirts, swimsuits, a raincoat, a hijab, and trousers. Testing showed that 11 of the 16 samples (68.8%) contained PFAS or had EOF levels indicating the presence of PFAS. Two swimsuits from India had levels above proposed EU safety limits.

- Of the 15 PFAS identified in the analyzed clothing, 6:2 FTOH was measured in the highest concentrations. The presence of FTOHs indicates that polymeric PFAS, i.e. side chain fluorotelomer-based polymers, were used in the products. Side-chain fluorinated polymers used in textiles degrade into other PFAS, including PFOA and other PFAS that are under current legislative scrutiny.

- Very few jackets and other textiles are recycled, meaning PFAS-treated clothing are likely to be landfilled or incinerated, releasing the chemicals into the environment where they will persist.

- Safer alternatives to PFAS exist and are used by responsible companies. In our study, we found 21 water- or stain-proof jackets without PFAS, including jackets made by North Face and Black Diamond, two companies that have committed to being PFAS-free. Several other outdoor clothing companies and retailers have also made this commitment, demonstrating that clothing can be made without PFAS.

- Some PFAS are regulated globally, regionally, or nationally. Three PFAS have been found to be among the most highly toxic chemicals known and are banned globally. But comprehensive regulations to protect the environment and human health from all PFAS are lacking.

This study demonstrates that the current process of regulating thousands of PFAS one-by-one or in small groups is not sufficient to control these harmful substances. Only a universal, class-based approach -including polymeric PFAS- resulting in a global ban of PFAS as a group can stop environmental releases of and human exposure to PFAS.

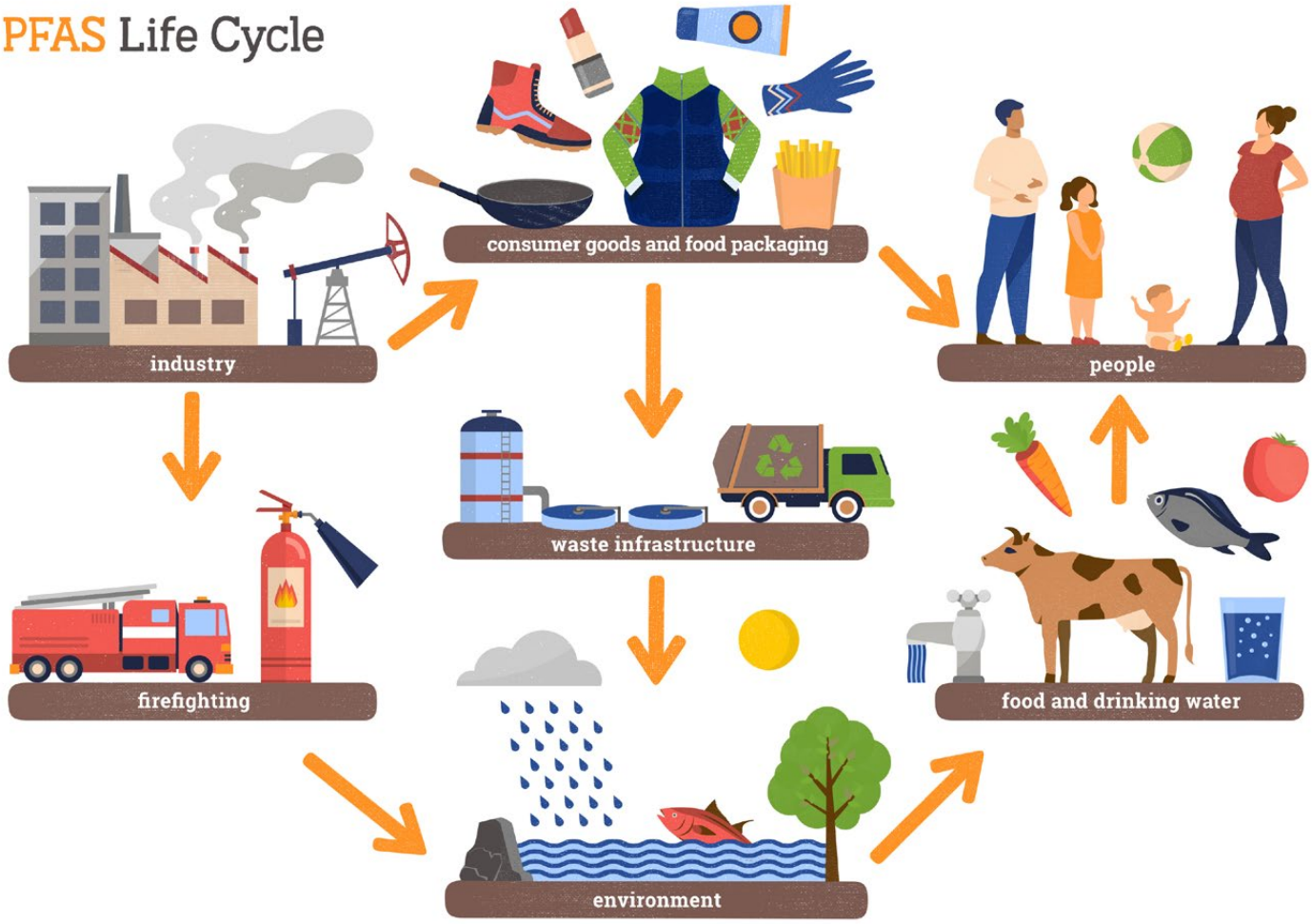
Background

THE PFAS PROBLEM

PFAS (per- and polyfluoroalkyl substances) are a large group of chemicals used ubiquitously in consumer and professional products, despite concerns around their health and environmental impacts. The OECD global database from 2018 counts over 4,700 PFAS available on the global market [1]. **They are used to make products water-, grease- and stain-resistant, and are commonly found in waterproof rain gear and food packaging, as well as in non-stick cookware and firefighting foams. However, most of the PFAS uses are not essential for the functioning of society and/or have safer alternatives that could be used instead [2].**

PFAS have been shown to be associated with a range of negative health impacts, including on fertility, fetal development [3] and thyroid hormone function [4, 5]. The normal functioning of thyroid hormones is important in several stages of life; for example, it is a vital factor for the development of the fetal and neonatal brain and a critical factor for menopausal symptoms during post-menopausal age. The negative impacts of PFAS on the immune system and their potential to make vaccines less effective [6-8] have been specifically highlighted in the context of the Covid-19 pandemic. In addition, elevated levels of PFAS in blood were found to be associated with an increased risk of a more severe Covid-19 infection [9].

All PFAS contain very strong chemical bonds between carbon (C) and fluorine (F) atoms, making them very stable and resistant to decomposition. This is why they are sometimes referred to as 'Forever Chemicals'. Studies have shown that PFAS are released into the environment at every stage of their life cycle, including production [10-12], use [13], and disposal [14, 15]. This, and their persistence, leads to continuously increasing concentrations of PFAS in the environment [16, 17]. PFAS have been detected in the air [18], soil [19], water [20] including drinking water sources [21], and household dust [22, 23]. When released, they can disperse over long distances and can be found far from the places of their origin, including in the Arctic [24, 25].



Humans are also continuously exposed to PFAS. Food and drinking water have been established as the main exposure routes to PFAS. However, exposure from dust, indoor environments, and personal care and consumer products are also important [26]. To date, human biomonitoring studies have detected PFAS in human breast milk, urine and blood samples including serum, plasma, and whole blood [27-29]. Scientific studies of PFAS concentrations in human blood show that marginalized communities living in contaminated and industrialized areas are especially exposed to PFAS [30]. Moreover, a recent study detected PFAS in breast milk of all 50 investigated mothers from the United States [31].

PFAS USE IN TEXTILES

Use of PFAS in the textile sector accounts for about 50% of the total global use of PFAS [32]. Textile manufacturers use PFAS to provide oil- and water-resistance for stain- and rain-proof materials. Thus, PFAS are widely used as water and dirt repellents and impregnators in outdoor wear and in accessories for outdoor sports (e.g., waterproof shoes, jackets, backpacks, tents). PFAS are also used to treat leather and household textiles such as carpets and tablecloths. Most of the uses of PFAS in textile products are not essential and have alternatives [33, 34]. Non-chemical alternatives for PFAS-treated textiles include tightly woven fabrics and plant-based materials.

The use of PFAS in textile and outdoor wear both increases environmental pollution and human exposure, as PFAS are released into the environment at every stage in the life cycle of a textile product (i.e., during production, use and final disposal). During the production phase, textile factories pollute the surrounding environment through emissions into air and wastewater [11] and expose workers to PFAS [35]. PFAS are volatilized, weathered and washed out from textile products during their use [36, 37]. FTOH concentrations inside sportswear stores selling outdoor clothing were found to be up to 30 times higher than in other working environments [38]. Conventional wastewater treatment plants do not typically have technologies for PFAS capture and

destruction, thus PFAS released in laundry water are discharged into waterways [39]. **When PFAS-treated articles are disposed of at the end of life, PFAS migrate from waste into landfill leachates [14], are emitted in incineration fumes and ashes or are recycled into new products [40].**

Annual PFAS emissions (related to new products on the market) from the use phase of Textiles, Upholstery, Leather, Accessories and Carpentry (TULAC) sector were in 2020 among the highest in comparison with other major PFAS use sectors as estimated by the European Chemicals Agency (ECHA) in the Universal PFAS restriction proposal[1]

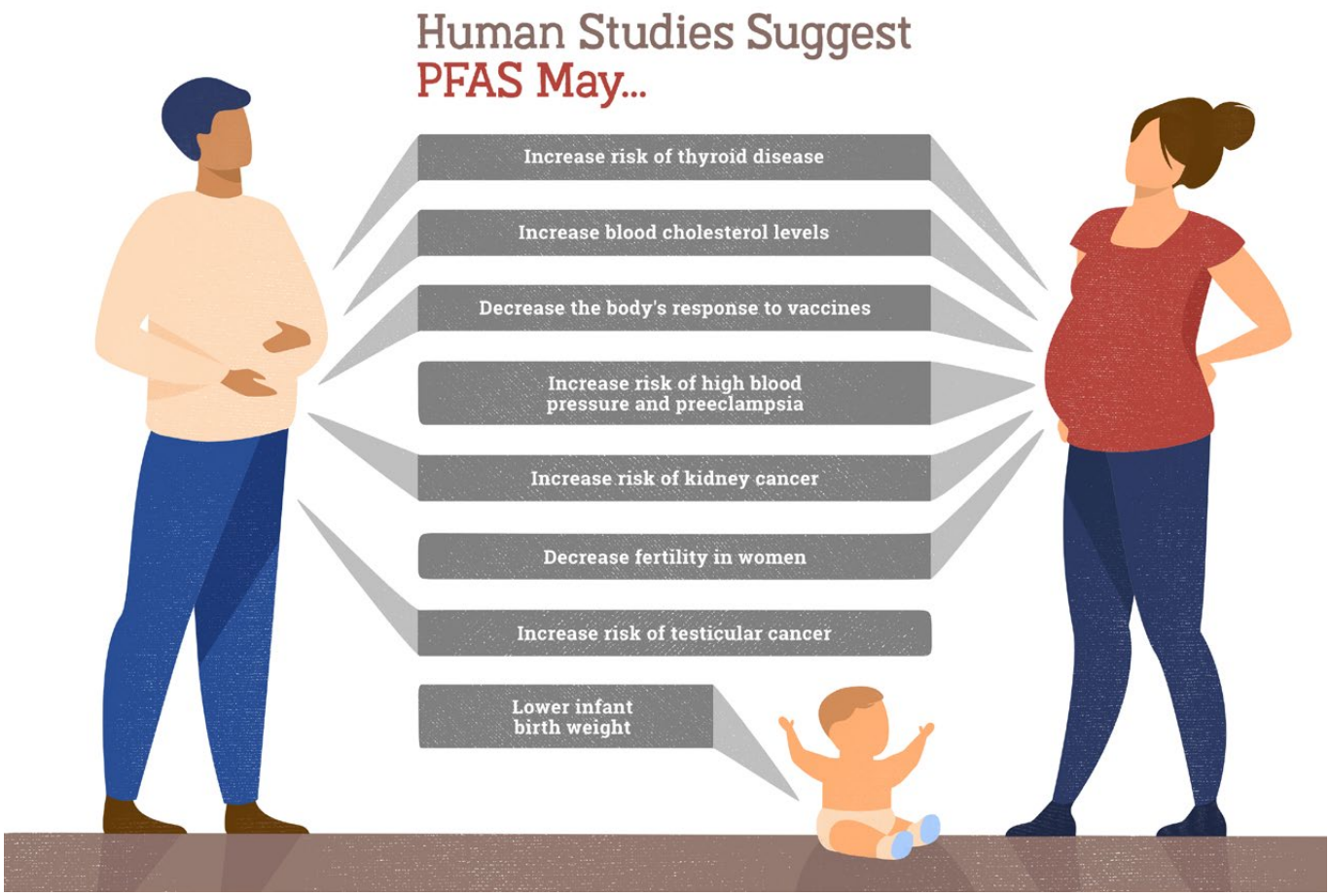
PFAS AND CHILDREN'S HEALTH

Most of the jackets analyzed in this study were marketed for children. A 2022 review by the American Academy of Pediatrics (AAP) of a two-year study by the National Academies of Science, Engineering, and Medicine found specific concerns for children from PFAS exposures [41]. The report concluded that an association is likely between chronic PFAS exposure in children and medical concerns such as elevated blood cholesterol levels, dyslipidemias (lipid imbalances related to cardiovascular disease), slightly lowered birth weight, and reduced antibody response to certain vaccines/infections. The AAP review noted that children are more vulnerable to PFAS because of lower body weight, differences in water and food intake, developing organ systems, breathing closer to the floor, and longer lifespans during which toxic effects might manifest.

1 **https://echa.europa.eu/documents/10162/57812f19-8c98-ee67-b70f-6e8a51fe77e5**

REGULATORY FRAMEWORK

PFAS are increasingly regulated nationally, regionally, and internationally (See Annex 2 for more details). Because of the gradual regulation of long-chain PFAS, these have increasingly been replaced with short-chain PFAS substitutes. Despite their lower bioaccumulation potential, short-chain PFAS are of increasing concern as they are ubiquitous in the environment, including in remote areas [42]. Short-chain PFAS are even more persistent and mobile in water than long-chain PFAS, and thus may pose more risks for the environment and human health [43].



Objective, scope, and methodology

This study was conducted to assess PFAS use in outdoor jackets and clothing on four continents, and to contribute to the discussion on the universal ban of all PFAS. It was conducted by IPEN and Arnika together with the following partner organizations Alaska Community Action on Toxics - ACAT (Alaska), BUND - Friends of the Earth (Germany), Buy Responsibly Foundation (Poland), Centre for Environment Justice and Development (Kenya), Centre for Environmental Justice (Sri Lanka), Ecological Alert and Recovery - EARTH (Thailand), Environment and Social Development Organization - ESDO (Bangladesh), Gramin Vikas evam Paryavaran Sanstha (India), Green Home (Montenegro), CHEM Trust (United Kingdom), Safer Chemicals Alternative - ALHem (Serbia), Tegengif Erase all Toxins (Netherlands), and Toxics-Free Future (United States of America).

SAMPLE COLLECTION

In total, over 100 softshell jackets and other clothing items, which are potentially waterproof or stain resistant by function and design, were purchased in seven European countries (Czech Republic, Germany, Netherlands, Poland, United Kingdom, Serbia and Montenegro), four Asian countries (Bangladesh, India, Sri Lanka and Thailand), in the United States (Alaska and an online store), and in Kenya. In Kenya, clothing was purchased at an open air second hand market in Nairobi called Toi Market in July 2021. In the Czech Republic, softshell jackets were purchased in both online and department stores in January and February 2022. The clothing items from other countries were also purchased from both online platforms and department stores between August and November 2022.

Most of the jackets purchased for this study were marketed towards children.

Of the 100+ clothing items, 72 items were selected for lab analysis to ensure geographical balance and highest possible similarity of types of tested clothing. Two pairs of identical jackets (US-PFAS-01/02 and US-PFAS-03/04) were included into the lab analysis, the rest of analyzed clothing differed one from the

other. Description of the lab-analyzed clothing items is given in Annex 3. The samples were analyzed at the Institute for Environmental Studies, Faculty of Science, Charles University, Czech Republic.

For the EOF and targeted PFAS analysis, the samples were prepared by cutting 100 cm^2 of fabric from the outer layer of each clothing item. After cutting, EOF/PFAS were extracted from the fabric with a mixture of methanol and ethyl acetate, and the extract obtained was subjected to the analysis itself (See Annex 4 for more details on detection and quantification of PFAS).

FLUORINE MASS BALANCE

The fluorine mass balance (proportion of unidentified organic fluorine and fluorine identified in targeted PFAS analysis) was calculated according to the method described in Schultes et al. (2019)[2].

See the diagram below illustrating potential different forms of fluorine in the samples.

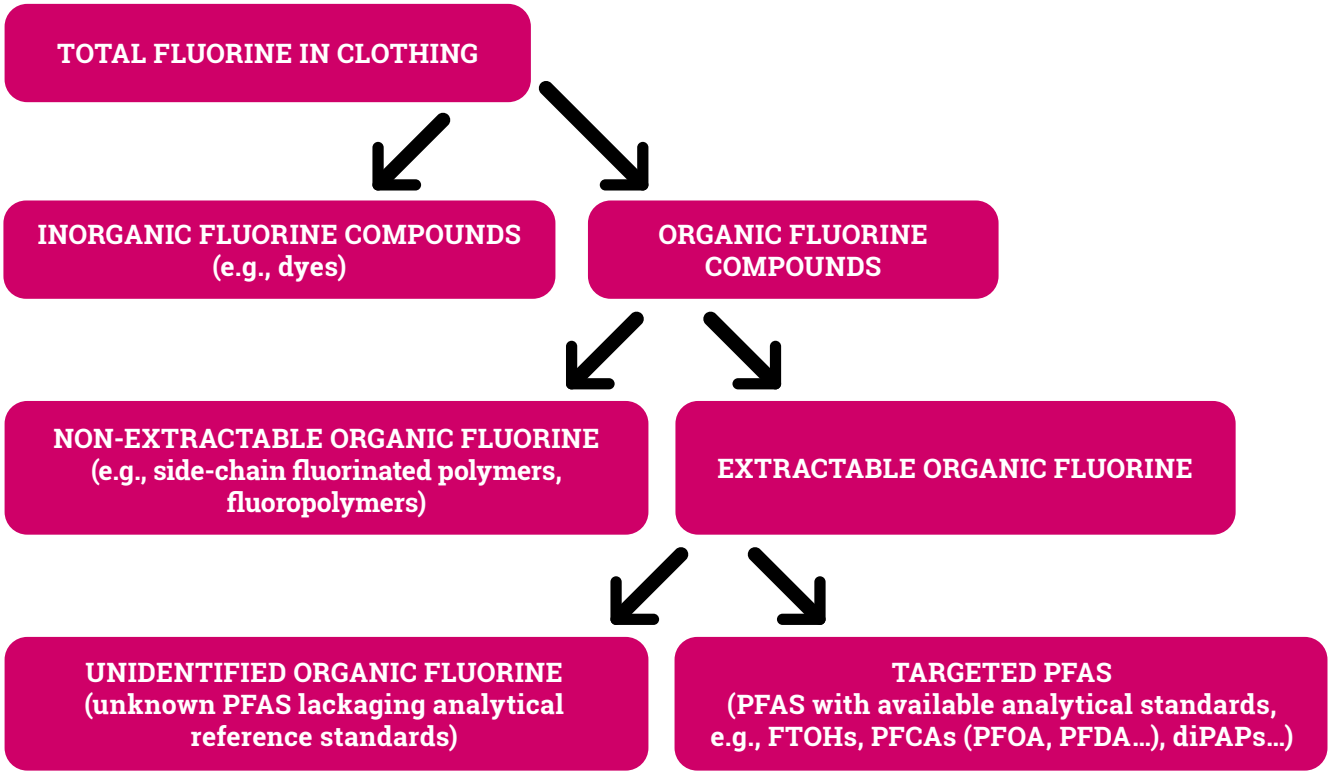
The fluorine mass balance involved converting the concentrations of the specified PFAS identified in a given sample into their fluorine equivalent and then comparing the sum of the identified fluorine with the organic fluorine amount measured in a given sample.

COMPARISON WITH LEGAL THRESHOLDS

Measured concentration of EOF and targeted PFAS (including globally banned PFOA) were compared with thresholds set in the existing and proposed legislation in the EU (See Annex 2 for more details).

2 Schultes, L., et al., *Total Fluorine Measurements in Food Packaging: How Do Current Methods Perform?* Environmental Science & Technology Letters, 2019. 6(2): p. 73-78.

Diagram 1: Different forms of fluorine/PFAS in clothing



Results

The majority, 46 of 72 samples (63.8%), of all lab-analyzed clothing was found to be PFAS-treated or -contaminated with EOF and targeted PFAS analysis (See Annex 5 for full results).

Sixteen out of 72 clothing items contained at least one targeted PFAS in concentration over 25 ppb, the threshold proposed in the prepared EU-wide PFAS restriction. Thirteen jackets contained at least one targeted PFAS in concentration over 25 ppb. Two jackets from the Czech Republic and one jacket from Kenya exceeded the EU threshold of 25 ppb for the cumulative sum of C9-C14 PFCAs. However, only between 0 and 25.9% (median 0.3%) of extractable organic fluorine present in the samples could be assigned to specific PFAS chemicals identified via targeted analysis.

The highest concentrations of targeted PFAS were identified in softshell jackets with the durable water-repellent (DWR) coating from the markets in the Czech Republic collected in early 2022. Out of the 15 different PFAS identified in the analyzed clothing, 6:2 FTOH (1070.5 ng/g) was measured in the highest concentration in a jacket with DWR from the Czech Republic.

The most common PFAS identified in the targeted analysis of 58 PFAS were PFOA and PFDA. PFOA was found in 17 jackets. It is listed in Annex A of the Stockholm Convention for global elimination. PFOA use is prohibited in consumer products in countries that ratified the Stockholm Convention amendment on PFOA (i.e., EU, UK, Serbia, Montenegro, Thailand, Sri Lanka, Bangladesh and Kenya). Another PFAS found in 17 tested samples was PFDA, a long-chain perfluorocarboxylic (PFCA), currently restricted by the EU REACH legislation on C9-14 PFCAs, and recommended by the POPs Review Committee, an expert body of the Stockholm Convention, for global elimination.

The concentration ranges and medians of EOF and targeted PFAS in tested clothing are summarized in Table 2.

JACKETS

35 out of the 56 lab-analyzed jackets (62.5%) purchased in Europe, US, Asia, and Africa had extractable organic fluorine (EOF) or targeted PFAS concentrations above the limit of quantification (LOQ).

The highest levels of EOF were measured in second-hand jackets purchased at a market in Kenya in 2021, one or two years earlier than the other clothing items involved in this study.

The highest levels of targeted PFAS were identified in softshell jackets with DWR coating from the markets in the Czech Republic purchased in early 2022. In Europe and the United States, out of the 15 different PFAS identified in tested jackets, 6:2 FTOH had the highest concentrations. PFHxA was the PFAS measured in the highest concentrations in Asian countries and Kenya.

Thirteen jackets contained at least one targeted PFAS in concentrations over 25 ppb, a threshold proposed by the EU-wide PFAS restriction. Two jackets from the Czech Republic and one jacket from Kenya exceeded the EU threshold of 25 ppb for the cumulative sum of C9-C14 PFCAs.

The most common PFAS identified in the targeted analysis of 58 PFAS was PFOA, found in 17 outdoor jackets and listed in Annex A of the Stockholm Convention for global elimination and restricted by the EU POPs Directive and respective national acts. In addition, at least one of the PFOA-related substances (i.e. 8:2 FTOH, 6:2/8:2 diPAP, or 8:2/8:2 diPAP) was quantified in 11 analyzed jackets.

The concentration ranges and medians (calculated from samples above LOQs) of EOF and targeted PFAS in tested jackets are summarized in Table 1.

OTHER CLOTHING

Other clothing items included aprons, T-shirts, swimsuits, a raincoat, a hijab and trousers. Of these, 11 out of the 16 (69%) lab-analyzed items had extractable organic fluorine (EOF) or targeted PFAS concentrations above the limit of quantification (LOQ).

The highest levels of EOF and targeted PFAS (6:2 FTOH) were detected in two swimsuits from India. These items exceeded the threshold for

The highest levels of PFAS were identified in softshell jackets with DWR from the Czech Republic

individual PFAS (25 ppm) proposed in the EU-wide PFAS restriction. PFHxA was the most common PFAS identified in clothing from Asia, and 6:2/6:2 diPAP in clothing from Kenya.

The concentration ranges and medians (calculated from samples above LOQs) of EOF and targeted PFAS in tested clothing (other than jackets) from Asia and Kenya are summarized in Table 2.

Clothing (other than jackets) with the highest levels of PFAS was a swimsuit from India

Elevated levels of PFAS were measured in water repellent t-shirt from Thailand

Table 1: Concentration ranges and medians (calculated from samples above LOQs) of EOF and targeted PFAS in tested jackets (ng/g or ppb)

	Jackets Europe	Jackets US	Jackets Asia	Jackets Kenya	Jackets all
Number of jackets with EOF or targeted PFAS above LOQ	17/32	7/10	9/12	2/2	35/56
EOF range	424.6 – 109 530.9	603.2 –10 253.4	251.3 – 15 326.6	225 343.2 – 545 667.7	251.3 – 545 667.7
EOF median	5 905.8	687.9	1373.3	x	4 094.1
Total PFAS range	4.9 – 1 304.7	3.8 – 983.0	3.4 – 31.9	251.8 – 526.6	3.4 – 1 304.7
Total PFAS median	66.8	14.8	13.5	x	31.9

Table 2: Concentration ranges and medians (calculated from samples above LOQs) of EOF and targeted PFAS in clothing other than jackets and in all tested samples together (ng/g or ppb)

	Asia textile	Kenya textile	All samples (incl. jackets)
Number of clothing items with EOF or targeted PFAS above LOQ	9/14	2/2	46/72
EOF range	367.8 – 9 624.4	1164.7 – 5084.1	251.3 – 545 667.7
EOF median	663.4	x	3 090.2
Total PFAS range	2.6 – 702.2	47.6- 432.5	2.6 – 1 304.7
Total PFAS median	6.5	x	39.8

Discussion

DURABLE WATER REPELLENT AND STAIN-RESISTANT COATING: SOURCES OF HUMAN EXPOSURE AND CONTRIBUTORS TO ENVIRONMENTAL LEVELS OF PFAS

PFAS in clothing can be a source of human exposure to PFAS via inhalation, ingestion and possibly also via dermal absorption [44-47]. Children are particularly sensitive to endocrine disrupting PFAS [48-53], which is especially concerning as most of the jackets investigated in this study were designed for children, whose skin may come into direct contact with the clothing.

Out of the 15 different PFAS identified in the analyzed clothing, 6:2 FTOH had the highest concentrations. There are multiple toxicological concerns regarding fluorotelomer alcohols (FTOHs) and their degradation products (perflurocarboxylic acids (PFCAs)). Both are associated with hepatotoxicity, mammary gland cancer, negative impacts on the reproductive system, and developmental disorders [54-56].

The majority (65%) of clothing selected for lab analysis were found to be PFAS-treated or -contaminated.

Both FTOHs, PFCAs, and related substances of 8 carbon-chain length or longer were prevalent in the analyzed items of clothing, including from the EU. Long-chain PFCAs and related compounds are restricted in the EU and recommended for global elimination under the Stockholm Convention.

Polyfluoroalkyl phosphoric acid diesters (DiPAPs) were identified in trousers and jackets from second-hand markets in Kenya exclusively. The use of diPAPs seems to be time- and/or geographically-limited. Kenyan samples were purchased 2 years earlier than the rest of the samples in this study and the age of the products is unknown, as they come from the second-hand market. Similarly to FTOHs, DiPAPs degrade to, for example, PFHxA, PFHpA, PFOA and PFNA [57, 58]. Toxicological concerns of DiPAPs are mainly related to their endocrine disrupting effects as well as to toxic properties of their degradation products [59, 60].

As only a fraction of the post-consumer synthetic outdoor and sportswear is recycled, the type of garments investigated here would mostly end up in landfills or be incinerated [61]. Disposal of PFAS-treated clothing and apparel in municipal incinerators potentially leads to emissions of PFAS, fluorinated greenhouse gasses and other products of incomplete combustion to the surrounding environment [62]. Additionally, some PFAS remain in the after-incineration fly ash [40].

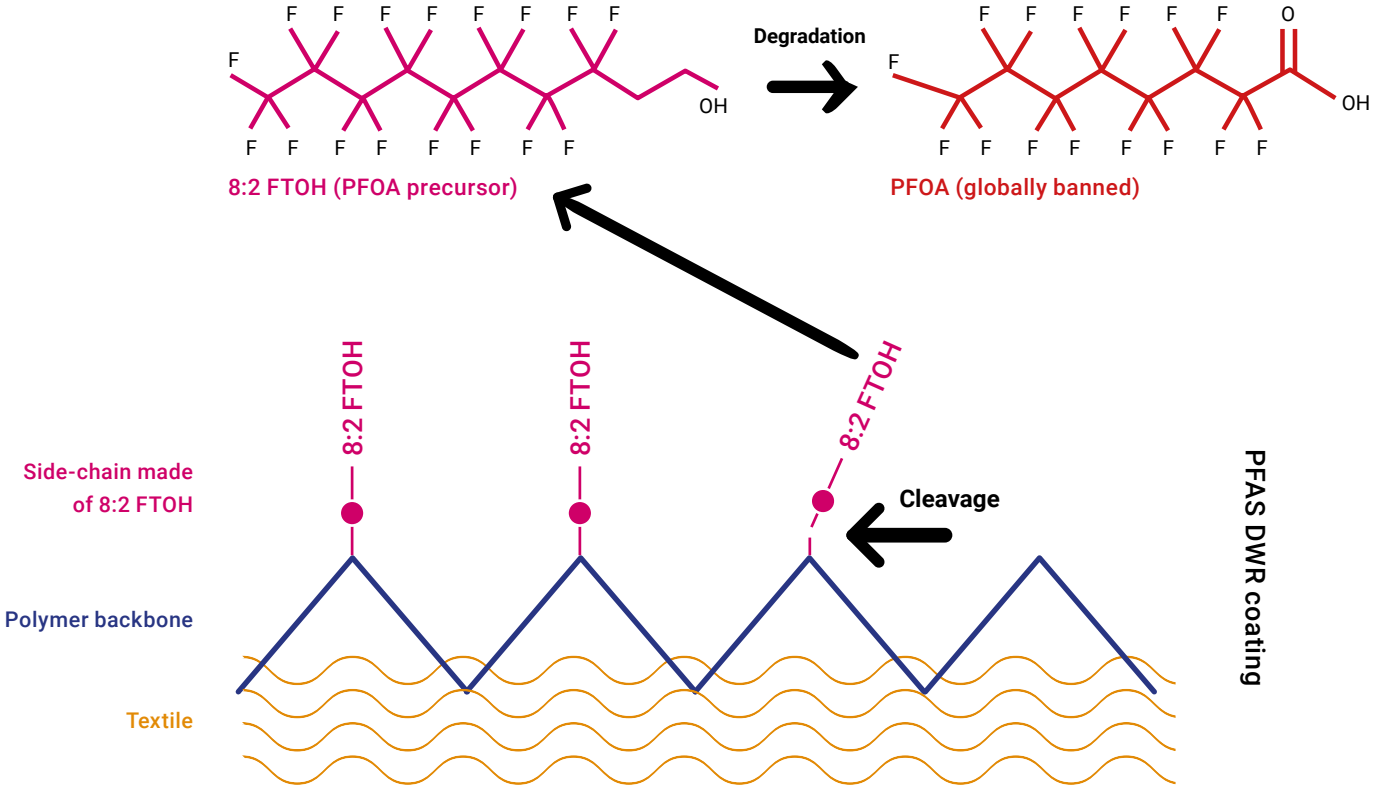
SIDE-CHAIN FLUORINATED POLYMERS IN CLOTHING: A SOURCE OF LEGACY PFAS

Water- and stain repellency is often obtained by treating textiles with side-chain fluorotelomer-based polymers (SFPs) [63]. These can be released from items of clothing due to degradation and loss of textile fibers during the entire life cycle [36, 37]. They are polymeric PFAS and not extractable, which means that they are not covered by the method used in this study.

However, side-chain fluorotelomer-based polymers are known to degrade and release non-polymeric PFAS that are extractable. For example, FTOH side-chains from SFPs degrade into PFOA and long-chain perflurocarboxylic acids) [64-66] (See Diagram 2). Therefore, the method used in this study can detect them and the results can be used to infer the use of side-chain fluorotelomer-based polymers. In other words, the presence of fluorocarboxylic acids (PFCAs) in samples investigated in this study can be the result of degradation of fluorotelomer-based side-chain polymers.

In an outdoor aging study [37], a proportion of SFPs was lost from functional clothing and levels of extractable PFAS were increased in textiles when exposed to direct sunlight, precipitation, wind, and heat. This means that aging and washing of fabrics coated with the DWR based on SFPs release PFASs into the environment [36, 37]. **Higher levels of FTOHs and PFCAs in second-hand jackets from Kenya and in jackets from the Czech Republic, which were bought 2 and 1 year earlier than the clothing items from other countries, respectively, can be explained by continuous degradation of side-chain fluorinated polymers from the textile material.**

Diagram 2: A simplified example of PFOA formation from side-chain fluorinated polymer applied as durable water repellent (DWR) coating on textile surface



Elevated levels of PFAS from samples from Kenya can be a result of material aging and weathering

Therefore, only a universal ban that includes side-chain fluorinated polymers and other polymeric PFAS can stop human exposure to PFAS from clothing.

CONCERNING PROPORTION OF UNIDENTIFIED PFAS

Only between 0 and 25.9% (median 0.3%) of extractable organic fluorine present in samples can be assigned to specific PFAS chemicals identified via targeted analysis. The limited number of identifiable PFAS in the textile samples highlights both the current limitations of targeted PFAS analysis, which are not able to identify PFAS such as fluorinated polymers, and the lack of commercially available standards to allow identification and quantification of all relevant PFAS used for treating textiles [67-69]. In this regard, the 15 identified PFAS are only the tip of the iceberg. Despite not being identified individually, concerns exist around the whole class of PFAS due to their ability to persist and accumulate in the environment. That means that it is not only challenging to identify the other PFAS present, but also to control them.

Only a universal ban of the entire class of PFAS and application of analytic methods enabling screening of the entire PFAS class (e.g., organic fluorine) is an effective measure to reduce releases of highly persistent PFAS into the environment.

PFAS IN SYNTHETIC CLOTHING: A BARRIER TO A NON-TOXIC CIRCULAR ECONOMY

There is an increasing demand for recycled textiles due to the need to move towards a more circular economy. When polyester, the prevalent material in the investigated samples, is mechanically recycled, the end-of-life products are likely be down-cycled (i.e. converted into products of lower value such as filler materials for furniture and insulation) [70] and contribute to PFAS contamination of the new products, environment, and biota [71, 72]. As a consequence, their presence in consumer products is even more difficult to trace, and legacy PFAS may find their way into products despite their restricted use.

Based on small-scale laboratory tests, it has been suggested that polyester might be chemically recycled (depolymerized). However, chemical recycling is not a viable option [73], and no depolymerization facility currently operates on a large-scale commercial basis [74]. The presence of PFAS in the post-consumer textile waste stocks constitutes a barrier to the recyclability of such products, especially because it is difficult to remove PFAS from the fibers once it was added [70, 75].

Therefore, recycling PFAS-treated textiles would lead to uncontrolled exposure to these forever chemicals, without any possibility of tracing their presence in other consumer products made of recycled materials.

ALTERNATIVES EXIST

A positive finding of the study is the identification of clothing with similar functional design that was confirmed to be PFAS-free. Twenty-one out of 56 tested jackets were found to be free of extractable PFAS. Analysis of jackets from international brands North Face or Black Diamond confirmed the success of their commitment to go PFAS-free. There are several other outdoor clothing companies that have announced a ban on PFAS use in their products, including Deuter, Jack Wolfskin, Mammut, ORTOVOX, Polartec and Vaude, and the retailer REI (which stated it will go PFAS free in 2024).

Taking into account that PFAS in clothing is not essential [2] and alternatives already exist [33, 34], use of PFAS should be banned and non-PFAS safer alternatives should be used instead.

MAIN FINDINGS AND CONCLUSIONS

The findings from previous studies show that:

- PFAS are continuously released into the environment during the entire life cycle of PFAS-treated product, where they persist at a level that causes them to be thought under the epitome of 'Forever Chemicals';
- When PFAS-treated products are recycled, PFAS can spread uncontrollably and contaminate new products, extending the toxic legacy of these chemicals and undermining the ability to transition to a clean, circular economy;
- Biomonitoring studies regularly detect PFAS in humans;
- PFAS have been associated with a wide range of negative environmental and health effects.

The findings of this study show that:

- The majority (65%) of clothing selected for lab analysis was found to be PFAS-treated or –contaminated;
- The presence of FTOHs and their degradation products indicate that durable water-repellency and stain-resistance of investigated clothing was achieved due to the application of side-chain fluorotelomer-based polymers;
- There are multiple toxicological concerns regarding fluorotelomer alcohols (FTOHs) and their degradation products. The most-frequently identified PFOA is listed for global elimination under the Stockholm Convention and should not be used in clothing. The other long-chain PFCAs are under regulatory pressure;
- The use of PFAS in clothing is not essential and alternatives already exist.

Setting legislative thresholds for a few small groups of PFAS is not sufficient to control these harmful substances in outdoor clothing. Only a universal ban including polymeric PFAS can stop human exposure and releases from clothing. Therefore, the most efficient control measure for reducing the releases of PFAS to the environment is to ban all PFAS in consumer products by 2025 in the EU or US, where appropriate legislation is already under development, and to have a complete global ban by the Stockholm Convention and national governments by 2030.

RECOMMENDATIONS

IPEN calls for banning the entire class of persistent PFAS as soon as possible to avoid hazardous (so-called "regrettable") substitutes and further emissions of PFAS into the environment [76]. Side-chain fluorinated polymers or fluoropolymers should be included in such a ban.

Based on the findings and conclusions of this survey, we call on:

ALL NATIONAL GOVERNMENTS:

1. To immediately ban all PFAS uses in clothes and other consumer products.
2. To support the development of a universal (covering all PFAS, including fluorinated polymers and side-chain fluorinated polymers) restriction on PFAS and thereafter fully implement it.
3. To require chemical and material transparency for products; i.e., adopt legislation requiring manufacturers to disclose their product ingredients to the public, retailers, and regulators.
4. To plan and promote economic incentives, financial support, and subsidies to facilitate the transition to PFAS-free alternatives, whilst ensuring a just transition for affected workers and communities.
5. To resource and improve analytical capacities of Customs departments to identify imported items containing or contaminated with PFAS.

THE EUROPEAN UNION:

1. To restrict all PFAS uses in the EU, including side-chain fluorinated polymers and fluoropolymers, by adopting the universal PFAS restriction proposed under the REACH legal framework.
2. To ensure that derogations are only granted to the few uses that are critical for health, safety and the functioning of society, and for which no alternatives are currently available - so called essential uses. Stringent risk-management

requirements (including labeling, monitoring and reporting) must be in place for derogated uses to ensure zero-emission into the environment at all stages of the life cycle.
3. To develop a swift and efficient plan for decontaminating soil and drinking water of affected communities living in the vicinity of production sites where PFAS are manufactured or used in the textile production, and to allocate sufficient funds for such remediation projects. The polluter-pays principle must be applied consistently, in particular to guarantee that the burden of cost is borne by the polluters, including the producer, rather than the taxpayer.
4. To adopt legislation ensuring that PFAS-containing textile waste is not being circulated back into the economy and the environment via recycling.

THE UNITED STATES:

We call on leaders at the state and federal levels:
1. To end the use of the entire class of PFAS in all textiles, and other products and packaging on urgent timelines.
2. To adopt comprehensive chemicals policies that require ingredient disclosure, restrict the most dangerous chemicals, and identify safer alternatives using tools such as GreenScreen for Safer Chemicals® and ChemFORWARD.
3. To use governmental purchasing power to avoid products containing PFAS, to use certifications such as EPA's Safer Choice and GreenScreen Certified to identify truly safer options.
4. To fully fund EPA and other state and federal regulatory agencies to address the PFAS and toxic pollution crisis.
5. To ensure cleanup of contaminated communities and safe disposal of contaminated products, and hold polluters financially responsible.

PARTIES TO THE STOCKHOLM CONVENTION:

1. To ratify the amendments listing PFOS, PFOA, and PFHxS to support the removal of all exemptions and acceptable purposes.
2. To implement bans on PFOS, PFOA and PFHxS in national regulations.
3. To support the listing of long-chain PFCAs and related substances for global elimination without exemptions.
4. To work for a class-based approach listing all PFAS for global elimination under the Stockholm Convention.

PARTIES TO THE BASEL CONVENTION:

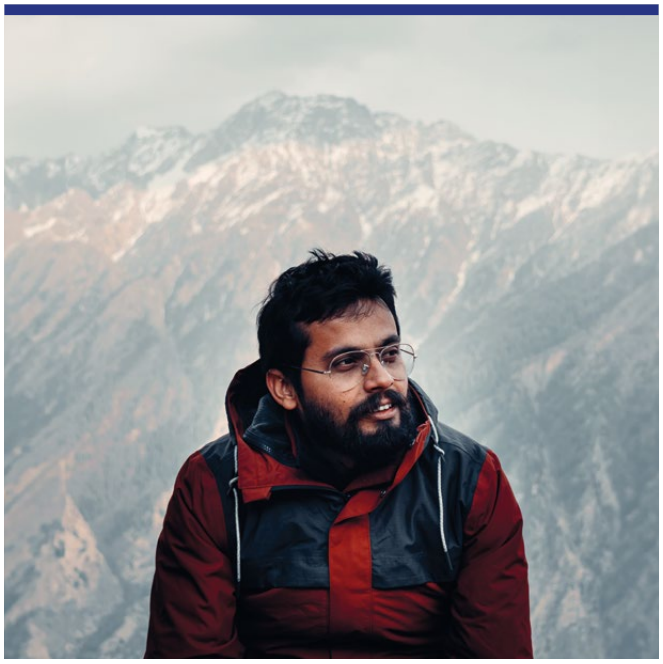
1. To define all PFAS-contaminated waste as hazardous waste based on their H11 (delayed or chronic toxicity) characteristics.
2. To ratify the Basel Ban amendment, ensuring no export nor import of PFAS-contaminated hazardous waste to non-OECD countries.
3. To acknowledge that polymeric fluorotelomer-based products (i.e., side-chain fluorinated polymers) as well as PFAS-contaminated products are non-recyclable, and hence non-circular, in the Technical guidelines on the identification and environmentally sound management (ESM) of plastic wastes and for their disposal.
4. To work for a class-based approach when determining maximum limits for PFAS content in waste (the so-called "low POP content" levels) and to set the level for the sum of PFAS at 10 mg/g (ppm).

SAICM STAKEHOLDERS:

1. To significantly increase efforts towards transitioning to safe, non-PFAS alternatives, including establishing ambitious deadlines for phasing out PFAS as a class for all uses not essential for the functioning of society. To significantly increase availability of information to support this effort, including analytical methods, hazard data for PFAS and information about non-PFAS alternatives.
2. To work towards full transparency of PFAS content in products and support consumers' right to know about and choose PFAS-free products. Sufficient information on PFAS in products, waste streams and recycled materials will improve monitoring of compliance of recycled materials and articles produced within existing legislation.

TEXTILE MANUFACTURERS:

1. To immediately adopt public policies that quickly phase out the use of all PFAS with quantifiable goals and timelines.
2. To assess any substitute chemicals for hazards using tools such as GreenScreen for Safer Chemicals® or ChemFORWARD to ensure that any replacement chemicals are the safest possible, excluding, at a minimum, GreenScreen Benchmark 1 chemicals.



3. To disclose all product ingredients.
4. To provide progress reports to the public on at least an annual basis.
5. To develop a swift and efficient plan for decontaminating soil and drinking water of affected communities and allocate sufficient funds for such remediation projects.

RETAILERS:

1. To adopt ambitious, safer-for-the-public chemicals policies that get ahead of the curve and ensure all textile products available for sale are free of PFAS.
2. To require suppliers to provide full disclosure of product ingredients.
3. To support governmental policy reforms worldwide to advance ingredient transparency, eliminate PFAS, and incentivize the development of green-chemistry solutions. Retailers are the closest to the consumer, and they should therefore, support reforms.

CONSUMERS:

1. To demand PFAS-free outdoor textiles and ask retailers for information about the PFAS content in their products.
2. To purchase PFAS-free outdoor textiles that are clearly labeled as PFAS-free on the product. PFOA-free is not sufficient, as there are other related PFAS that may be used for water-resistance treatment. Check whether popular brands have committed to go PFAS-free at **www.pfasfree.org.uk/pfas-free-products** and **www.pfascentral.org/pfas-free-products**.
3. To inquire about the PFAS policy for ecolabels such as OekoTex.
4. To follow instructions for washing textiles. Wash them as rarely as possible to keep the water resistance functional and limit PFAS release into water in case PFAS-containing textiles are owned.
5. To use PFAS-free waterproof and impregnation solutions for outdoor textiles.
6. To ask your local waste facility or waste management authorities about how to safely dispose of PFAS- containing textiles or other products.
7. To spread the word on social media - using the #BanPFAS hashtag - to increase public pressure for a ban of PFAS chemicals.

ANNEXES

Annex 1: List of targeted PFAS tested in lab analysis

PFAS	Name	CAS	Limit of quantification of LC-MS analysis (ng/ml extract)	Limit of quantification of entire method (ng/100cm^2 fabric)
PFBA	perfluoro-n-butanoic acid	375-22-4	1	15
PFPeA	perfluoro-n-pentanoic acid	2706-90-3	1	15
PFHxA	perfluoro-n-hexanoic acid	307-24-4	0.25	3
PFHpA	perfluoro-n-heptanoic acid	375-85-9	0.1	1
PFOA	perfluoro-n-octanoic acid	335-67-1	0.1	1
PFNA	perfluoro-n-nonanoic acid	375-95-1	0.2	3
PFDA	perfluoro-n-decanoic acid	335-76-2	0.1	1
PFUnDA	perfluoro-n-undecanoic acid	2058-94-8	0.1	1
PFDoDA	perfluoro-n-dodecanoic acid	307-55-1	0.1	1
PFTrDA	perfluoro-n-tridecanoic acid	72629-94-8	0.1	1
PFPrS	perfluoropropanesulfonic acid	423-41-6	0.25	3
PFBS	perfluorobutane sulfonate	375-73-5	0.5	7
PFPeS	pentanesulfonic acid	2706-91-4	0.1	1
PFHxS	perfluorohexane sulfonate	355-46-4	0.25	3
PFHpS	perfluoroheptane sulfonate	375-92-8	0.1	1
PFOS	perfluorooctane sulfonate	1763-23-1	0.1	1
PFNS	perfluorononane sulfonic acid	68259-12-1	0.25	3
PFDS	perfluorodecane sulfonic acid	335-77-3	0.1	1
PFDoDS	sodium perfluoro-1-dodecanesulfonate	1260224-54-1	0.1	1
n-Met-PFBSA	n-methyl-perfluoro-1-butane sulfonamide	68298-12-4	0.5	7
PFOSA	perfluorooctane sulfonamide	754-91-6	0.1	1
n-Et-PFOSA	n-ethyl-perfluoro-1-octane sulfonamide	4151-50-2	0.1	1
n-Met-PFOSA	n-methyl-perfluoro-1-octanesulfonamide	31506-32-8	0.25	3
3:3 FTA	fluorinated telomer acid (3:3)	356-02-5	1	15
5:3 FTA	fluorinated telomer acid (5:3)	914637-49-3	0.5	7
7:3 FTA	fluorinated telomer acid (7:3)	812-70-4	0.25	3
9-Cl-PF3ONS	potassium-9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	73606-19-6	0.1	1

PFAS	Name	CAS	Limit of quantification of LC-MS analysis (ng/ml extract)	Limit of quantification of entire method (ng/100cm² fabric)
11-Cl-PF3OUdS	potassium-11-chloroeicosafluoro-3-oxaundecane-1-sulfonate	83329-89-9	0.1	1
NaDONA	sodium dodecafluoro-3H-4, 8-dioxanonanoate	958445-44-8	0.1	1
GenX	2,3,3,3-tetrafluoro-2-(heptafluoropropoxy) propanoic acid	13252-13-6	0.1	1
FOSAA	perfluoro-1-octanesulfonamidoacetate	2806-24-8	0.5	7
n-Met-FOSAA	n-methyl-perfluoro-1-octanesulfonamidoacetate	2355-31-9	0.5	7
n-Et-FOSAA	n-ethyl-perfluoro-1-octanesulfonamidoacetate	2991-50-6	0.5	7
4:2 FTS	fluorinated telomer sulfonate (4:2)	27619-93-8	0.5	7
6:2 FTS	fluorinated telomer sulfonate (6:2)	27619-94-9	0.25	3
8:2 FTS	fluorinated telomer sulfonate (8:2)	27619-96-1	0.25	3
10:2 FTS	fluorinated telomer sulfonate (10:2)	108026-35-3	0.25	3
4:2 FTOH	2-perfluorobutyl ethanol	2043-47-2	25	350
5:2 FTOH	1-perfluoropentyl ethanol	914637-05-1	10	150
6:2 FTOH	2-perfluorohexyl ethanol	647-42-7	15	200
7:2 FTOH	1-perfluoroheptyl ethanol	24015-83-6	2.5	35
8:2 FTOH	2-perfluorooctyl ethanol	678-39-7	2.5	350
10:2 FTOH	2-perfluorodecyl ethanol	865-86-1	1	15
6:6 PFPi	sodium bis(perfluorohexyl) phosphinate	70609-44-8	0.1	1
6:8 PFPi	sodium perfluorohexylperfluorooctyl phosphinate	2361298-14-6	0.1	1
8:8 PFPi	sodium bis(perfluorooctyl) phosphinate	500776-69-2	0.1	1
6:2 PAP	sodium 1H,1H,2H,2H-perfluorooctyl phosphate	150033-29-7	0.25	3
8:2 PAP	sodium 1H,1H,2H,2H-perfluorodecyl phosphate	438237-75-3	1	15
6:2/6:2 diPAP	sodium bis(1H,1H,2H,2H-perfluorooctyl) phosphate	407582-79-0	0.25	3
6:2/8:2 diPAP	sodium (1H,1H,2H,2H – perfluorooctyl-1H,1H,2H,2H-perfluorodecyl) phosphate	N/A	0.5	7
8:2/8:2 diPAP	sodium bis(1H,1H,2H,2H-perfluorodecyl) phosphate	114519-85-6	0.25	3
PFHpPA	perfluoroheptylphosphonic acid	N/A	0.25	3
PFECHS	potassium perfluoro-4-ethylcyclohexane-sulfonate isomeric mix	335-24-0	0.25	3
PFHxPA	perfluorohexylphosphonic acid	40143-76-8	0.25	3
Cl-PFHxPA	6-chloroperfluorohexylphosphonic acid	N/A	0.25	3
PFOPA	perfluorooctylphosphonic acid	40143-78-0	0.25	3
Cl-PFOPA	8-chloroperfluorooctyl-phosphonic acid	N/A	0.25	3
PFDPA	perfluorodecylphosphonic acid	52299-26-0	0.25	3

Annex 2: Legal framework

STOCKHOLM CONVENTION INCLUDES SOME PFAS

PFOS, PFOA, and PFHxS are listed in the Stockholm Convention for global restriction and elimination.

The PFOS listing entered into force for most countries including those involved in our survey in 2010 (for Montenegro in 2011). The PFOS listing was amended in 2020 in most of countries (in Bangladesh in 2023).

The PFOA listing entered into force for most countries in 2020, including those involved in our survey (for Bangladesh in 2023).

The only exceptions are India and the United States, because India has not accepted the PFOS and PFOA amendment and the U.S. is not a Party to the Stockholm Convention.

The amendment to list PFHxS, its salts and PFHxS-related compounds in Annex A will enter into force for most Parties in 2024. Listing long-chain perfluorocarboxylic acids (PFCAs), their salts and related compounds in Annex A (global elimination) has been recommended to the next Conference of Parties to the Stockholm Convention in 2025.

In 2009, when PFOS was listed in the Stockholm Convention, many exemptions accompanied its listing that permitted continued production and use. Some exemptions for PFOS still remain, but not for any of the products analyzed in this report.

The Stockholm Convention allowed a five-year exemption for PFOA use in textiles, but only for *"the protection of workers from dangerous liquids that comprise risks to their health and safety."* This indicates that production and sale of new food packaging, consumer textiles, and clothing containing PFOA should not be permitted.

PFHxS was listed in the Stockholm Convention without exemptions. When the amendment enters into force in November 2024, no new production or sale of products containing this substance will be permitted.

A recommendation for listing of long-chain perfluorocarboxylic acids (PFCAs) for global elimination is currently being finalized by the POPs Review Committee, an expert body of the Stockholm Convention.

REGULATORY FRAMEWORK IN THE EU

The EU POPs Regulation 2019/1021, which transposes the Stockholm Convention restrictions into European legislation, sets a maximum concentration for the use in consumer products, including textiles:

- PFOA and PFHxS (including their salts) individually: 0.025 mg/kg (25 ng/g or ppb)
- PFOA-related compounds: sum concentration of 1 mg/kg
- PFHxS-related compounds: sum concentration of 1 mg/kg
- PFOS and its derivatives: 10 mg/kg in substances or mixtures
- PFOS and PFOA may not be used in quantities of more than 1 $\mu g/m^2$ of the surface of the treated material.

In February 2023, a restriction covering about 200 long-chain PFCAs (C9-C14) and their precursors (chemicals that degrade into these) came into force in the EU. The threshold for restriction is 25 ppb for the cumulative sum of C9-C14 PFCAs and their salts, and 260 ppb for their related substances. There is also a proposal for restricting the PFAS chemicals PFHxA as well as their precursors.

Several PFAS are identified as substances of very high concern (SVHCs) under the EU REACH legislation (e.g., GenX, PFBS). This means that manufacturers, suppliers, and retailers have to communicate throughout the supply chain about the presence of these substances in products if they contain more than 0.1% of any SVHC substance. However, this

threshold is not enough to be protective, since it is far too high and only comes with communication requirements and not additional measures.

In 2023, an EU-wide restriction proposal of all non-essential uses of the entire group of PFAS was published by the European Chemicals Agency (ECHA). When adopted, it will ban the manufacturing, placing on the market and use of PFAS as such, as constituents in other substances, in mixtures, and in articles above a set concentration limit. Almost no exemptions or transition periods are proposed for textiles, since there are viable alternatives available already now on the EU market (a few minor exemptions are proposed for protective professional textile equipment). The proposal also describes the entire textile sector, which covers textiles, upholstery, leather, apparel and carpets as the second largest PFAS emissions contributor.

It proposes the following restriction limits:

1. 25 ppb for any PFAS (except polymeric PFAS; measured by targeted PFAS analysis),
2. 250 ppb for the sum of PFAS, optionally with prior degradation of precursors (measured, for example, by TOP assay), and
3. 50 ppm for PFAS, including polymeric PFAS (measured as total organic fluorine).

REGULATORY FRAMEWORK IN THE UNITED KINGDOM, SERBIA, AND MONTENEGRO

United Kingdom

The United Kingdom (UK) implements the Stockholm Convention. While it has been amended to become The Persistent Organic Pollutants (Amendment) (EU Exit) Regulations 2020, the same provisions apply. Therefore, three groups of Stockholm-listed PFAS, i.e., PFOS, PFOA, PFHxS are banned in the UK. A ban on PFHxS was recently adopted by the Parliament, and another PFAS subgroup, TDFAs, is restricted. Except for these, all other PFAS can be produced and used in consumer products or industrial applications in the UK.

Serbia

The Serbian national regulation related to PFAS is harmonized with the EU POPs Regulation 2019/1021 (except for waste management) by adopting the Rulebook on Bans and Restrictions, Placing on the Market and Use of Chemicals in May 2022 (Official Gazette of the Republic of Serbia No. 57/2022). However, since the EU issued two amendments in 2023 (EU Regulation 2023/1608 and EU Regulation EU 2023/866) there is a need to transpose these amendments into Serbian regulation (this procedure is ongoing).

National legislation also needs to be amended to transpose EU Regulation 2021/1297 amending Annex XVII to REACH as regards perfluorocarboxylic acids containing 9 to 14 carbon atoms in the chain (C9-C14 PFCAs), their salts and C9-C14 PFCA-related substances (this procedure is also ongoing).

Montenegro

PFAS and overall chemical legislation of Montenegro is harmonized with the EU directives (e.g., EU chemical legislation REACH or the EU POPs Directive) via a Law on Chemicals (Official Gazette of the Republic of Montenegro No. 51/17) and the Rulebook on the List of Classified Substances (Official Gazette of Montenegro No. 11/18). However, some of the recent EU amendments need to be transposed (similar to the situation in Serbia described above).

REGULATORY FRAMEWORK IN THE US

Although the United States has no federal legislation on PFAS, state governments are taking legislative and regulatory actions to phase out PFAS in products to prevent contamination in favor of safer alternatives. For example, laws in Maine, Minnesota, and Washington have given state agencies the authority to ban PFAS in a wide range of products. Maine and Minnesota's laws require manufacturers to disclose the presence of PFAS. Several states adopted restrictions on PFAS in textiles with California banning PFAS in almost all textiles, New York restricting them in apparel, Colorado and Minnesota banning them in upholstered furniture, and Washington moving forward on regulatory actions on many categories of textile products. Eight states (California, Colorado, Maine, Maryland, Minnesota, New York, Vermont, and Washington) adopted restrictions on PFAS in carpets, rugs, and aftermarket treatments. Twelve states (California, Colorado, Connecticut, Hawaii, Maryland, Maine, Minnesota, New York, Oregon, Rhode Island, Vermont, and Washington) have enacted state bans on PFAS in food packaging. Six states (California, Colorado, Maryland, Minnesota, Oregon, and Washington) adopted restrictions on PFAS in personal care products. Colorado also adopted restrictions on oil and gas products. Twelve states (California, Colorado, Connecticut, Hawaii, Illinois, Maine, Maryland, Minnesota, New Hampshire, New York, Vermont, and Washington) banned the sale of firefighting foam containing PFAS. With legislation adopted last year, Washington is evaluating safer alternatives for PFAS in products such as apparel,

cleaners, coatings, floor finishes, firefighter turnout gear, and others with a timeline of adopting restrictions by 2025.

REGULATORY FRAMEWORK IN ASIA

Bangladesh

There are no specific laws and regulations in Bangladesh related to PFAS chemicals. However, separated laws and regulations address this issue. These laws provide specific provisions for managing industrial waste and hazardous chemicals, including waste disposal, treatment, and storage guidelines.

India

There are no PFAS regulations in India although it ratified the Stockholm Convention in 2006. Since then India has yet to accept the amendments listing PFOS, PFOA and PFHxS.

Sri Lanka

The list of Special Import License Regulations (Gazette Extraordinary 2044/40, November 2017) contains substances that can be imported under a license. The list contains several perfluorooctane substances under the HS code 29.04 (sulfonated, nitrated or nitrosated derivatives of hydrocarbons, whether or not halogenated) and HS code 2922.16 diethanolammonium perfluorooctane sulfonate.

Thailand

PFOS, PFOA and related substances (mainly their direct precursors) are among Hazardous Substances listed by the Thai Ministry of Industry. Their production, importation, exportation, and possession requires permits or are prohibited above the impurity threshold.

REGULATORY FRAMEWORK IN KENYA

There are no explicit laws or regulations in Kenya for the management of PFAS. However, Kenya has developed a ‘draft toxic and hazardous chemicals and materials management regulations, 2019’. In this regulation PFAS is listed under the first schedule as a hazardous chemical and will be subjected to restrictions.

Annex 3-A: Description of lab-analyzes samples

Waikiki · The North Face · Husky · GRLGIMAP · Decathlon · Columbia · GQ

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
1	CZ-OUTD-01A	jacket	Czechia	Elsho girl's jacket Pink children's jacket	AlpinePro	Store at Palladium Shopping mall - retailer Sportisimo	Bangladesh	-	Outer: 100% polyester, Padding: 100% polyester	Teflon Ecolite	Wash with dark colors, only gentle detegent, close all the zips before washing, do not use softeners, wash inside out	No	-
2	CZ-OUTD-02A	jacket	Czechia	Inucon boy's jacket Dark blue children's jacket	Loap	Store at Palladium Shopping mall - retailer Sportisimo	China	-	Outer: 100% polyester, Lining:100% polyester; Padding: 100% polyester	DRYTECH (high quality polyurethane coating)	Wash the product before its first use, all the zippers and velcros must be closed before washing, do not wash and soak separately, wash in sufficient amount of water, use liquid washing product for colored cloths, do no use softeners, do not dry close to a heater, do not dry on a direc sun	Yes	-
3	CZ-OUTD-03A	jacket	Czechia	Milo J Blue-green children's jacket	Kilpi	E-shop HS sport	China	-	Outer: 94% Polyester, 6% elastane, padding: 100% Polyestere	Technology SIBERIUM 5000 SRC SS. B	Wash at 30°C, if print on the outside, wash and iron upside down	Yes	-
4	CZ-OUTD-04A	jacket	Czechia	Zally kids jacket	Husky	E-shop Husky	China	-	100% polyester	Extend Pro Softshell Stretch 10 000, DWR, water column 10 000 mm H2O	Wash at 30 C, close all the zippers and velcros before washing, do not use softeners	Yes	-
5	CZ-OUTD-05A	jacket	Czechia	Zunat kids jacket	Husky	E-shop Husky	China	-	Outer: 100% polyester, membrane: 100% polyurethane, inner: 100% polyester	Extend Pro Softshell Stretch 10 000, DWR. Water column 10 000 mm H2O	Wash at 30 C, close all the zippers and velcros before washing, do not use softeners	Yes	-
6	CZ-OUTD-06A	jacket	Czechia	Peeta Junior children's jacket	Hannah	Store Rockpoint - Na Porici, Prague 1	China	-	100% polyester outer, % polyester inner	Coating: Drypeak6000	Wash at 30°C, wash separately, do not use bleach or softener, close all the zips, rinse thoroughly	Yes	-
7	CZ-OUTD-07A	jacket	Czechia	Children's jacket	NordBlanc	E-shop Nord Blanc	China	-	95% Polyestere, 5% Elastane	3-layer materials with a membrane SOFTSHIELD® 5000.	Wash at 30°C	No	-
8	CZ-OUTD-08A	jacket	Czechia	Teenager's jacket	Progress	E-shop Progress	China	-	100% Polyestere	DWR coating with longlasting effect, 100% polyester	Wash at 30 C, wash before use, wash separately with mild detergent with similar colors	Yes	-
9	CZ-OUTD-09A	jacket	Czechia	Teenager's jacket	Woox	E-shop Woox	China	-	100% Polyester	Water repellent 8000mm, vapour release 3000g/m2/24h.	Wash at 30°C	Yes	-
10	CZ-OUTD-10A	jacket	Czechia	Teenager's jacket	NorthFinder	E-shop North Finder	Vietnam	Light water resistent jacket	100% Polyester	-	Wash at 30°C, do not soak for long periods of time	Partialy yes	-
11	RS-PFAS-01	jacket	Serbia	Children's jacket for boys "Start Action"	LC Waikiki	LC Waikiki, Stadion Shopping Center, Zaplanjska 32, 11010 Belgrade, Serbia	Turkey	Rain children jacket (12-13 y) with a hood, basic color is black and fluorescent yellow from the inside	Exterior: 100% polyester, body lining:100% polyester	Water-Repellent, Windproof	Wash 30°C, separately or with similar colorous and dry separately, do not bleach, do not tumble dry, and iron on low temp.	Yes	-

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
12	RS-PFAS-02	jacket	Serbia	Children's jacket for girls 14+	Terranova brand	Terranova, Stadion Shopping Center, Zaplanjska 32, 11010 Belgrade, Serbia	Myanmar	Warm padded jacket in silver-gold color with a hood for girls	Outer: 100% polyester, Lining:100% polyester; Padding: 100% polyester	Water-Repellent	Wash 30°C, separately or with similar colorous inside out, do not bleach, do not tumble dry, do not dry clean, do not iron	Yes	-
13	RS-PFAS-03	jacket	Serbia	Children's outdoor softshell jacket for boys "A.W.S Active" (9-10 y)	Icepeak, A.W.S, Luhta Sportswear company, Finland	Intersport S Trgovina doo, Stadion Shopping Center, Zaplanjska 32, 11010 Belgrade, Serbia	China	Blue jacket with orange zippers with a hood	Exterior: 89% polyester, 11% elastan; Reverse side:100% polyester	Waterproof and breathable fabric: 8000 mm/3000 g/m2/24h	Wash 40°C, separately inside out, do not use fabric softener, close zippers before washing, do not bleach, do not tumble dry, do not dry clean, iron on low temp.	No	The material protects you efficiently from wind and water, and the breathability adds to the wear comfort. Comfortable and functional softshell material for versatile outdoor activities. The product contains reflective elements, but it is not a reflector.
14	RS-PFAS-04	jacket	Serbia	Baby's jacket for boys "So Cute"(2-3 y)	PEPCO baby	Pepco doo, Stadion Shopping Center, Zaplanjska 32, 11010 Belgrade, Serbia	Bangladesh	Warm padded jacket in three colorous (dark blue, white and brown) with a hood for boys	Outer: 100% polyester, Lining:100% polyester; Padding: 100% polyester	Water Repellent	Wash 30°C, separately with similar colorous, wash and iron inside out, keep away from fire, do not bleach, do not tumble dry, do not dry clean, iron on low temp.	Yes	-
15	NL-PFAS-01	jacket	Netherland	Flash Challenger Windbreaker	Columbia	E-shop Columbia sportswear	Bangladesh	Fuchsia and blue raincoat kids	100% Polyester	-	Wash at 30°C, mashine wash cold gentle cycle	Yes	-
16	NL-PFAS-02	jacket	Netherland	Sailing 300	Tribord	Decathlon Online	Vietnam	Petrol sailing coat kids	Main fabric: 100% polyamide, coating 100% polyurethane	-	Mashine wash at 30°C	No	-
17	NL-PFAS-03	jacket	Netherland	Centro jr Softshell tussenjas - Swamped	Protest	E-shop Protest	China	Green softshell coat girls	-	8000 water column	Wash at 30°C	Yes	-
18	NL-PFAS-04	jacket	Netherland	Kids' Unisex Amterdam Proof regenjas	Scotch& Soda	Eshop Scotch & Soda	China	Kids raincoat green	100% Polyester	Waterproof	Hand wash cold	Yes	-
19	PL-PFAS-01	jacket	Poland	Children's jacket	IGUANA	E-shop iguana	China	Lola II KDG	94% Polyester, 6% Elastane	DWR - durable water repellent	Wash at max. 30°C, separately or with similar colors, do not iron, do not bleach, do not tumble dry, do not dry clean	No	-
20	PL-PFAS-02	jacket	Poland	Women's jacket	North Face	E-shop	Bangladesh	W Quest jacket	Outer: 100% polyester, Lining:100% polyester; Padding: 100% polyester	Dryvent, fully waterproof	Wash 40°C, mashine wash separately gentle cycle, wash separately, close all fasteners before washing, use mild detergent	No	This material is completely waterproof, windproof and breathable
21	DE-PFAS-01	jacket	Germany	Children's jacket	Erima	E-shop indoor-trends.de	Bangladesh	Jacket in green (fern green/ smaragd) GTIN: 4062075117669 Art no: 2062218; 20210300; BD: PO-20210300	100% Polyester	10.000 mm Waterproof, 6.000 g/m²/24h breathable, windproof	Wash at 30°C, no tumble dryer, no softener, no bleaching or chemical cleaning; close zippers before washing, use colour detergents, wash inside out with similar colours	Yes, but only for 2 secs	-

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
22	DE-PFAS-02	jacket	Germany	Children's jacket	CMP	SportS-check	Bangladesh	Jacket in blue with yellow in-side, 3A00094M, 10NL GTIN 8057153919217	100% Polyester	Waterproof, 7.000 WP, 3.000 MVP	Wash inside out, delicate wash at max 30 °C, do not bleach, tumble dry at max 60 °C, do not iron, do not dry clean, professional wet cleaning, mild process	Yes	3 layered water and windproof textile, a special thermal laminate applied between the garment's fab-ric layers, that protects against the weather and at the same time guarantees great breathability
23	UK-PFAS-01	jacket	UK	Junior Mini Tornado Waterproof Jacket	Peter Storm	E-shop Blacks	China	Lightweight waterproof jacket with hood ; Colour: Silver; Taped seams; Full-length zip with puller; Two zipped side pockets	100% polyester	The Peter Storm Mini Tornado Waterproof is a shield from sudden downpours. Using Storm-shield technology, the lightweight fabric promotes ventilation and breathability while protecting from outside moisture. The jacket has also been treated with a Durable Water Repellent, meaning rain and snow simply runs off the surface.	Machine wash at 30C; do not bleach; do not tumble dry; do not iron; do not dry clean; after extended wear or washing you might need to re-treat the outer fabric with a reproofing agent; secure all fastening before washing	No	No PFC policy, some items are la-belled PFC-free, some are not. This one is not.
24	UK-PFAS-02	jacket	UK	Kids' Hybrid Jacket	Berghaus	E-shop Moutain Ware-house	China	Hybrid jacket with Insulated core and fleece hood and arms; colour: dark pink; Full-zip fas-tening; Attached hood; 2 x zip hand pockets	Front & back body, front zip guard and inner seam binding materials: 65% polyester / 35% polyamide; Hood, sleeves and side panel material: 230gsm hard face fleece; Inner zip guard and pocket bag ma-terial: 100% polyester tricot; Wadding material: 100% polyester wadding;	Find middle ground with the Kids' Hybrid Jacket from Berghaus. Providing insulation at its core alongside fleece arms for freedom of movement, kids' can enjoy the outdoors with no boundaries this season. DWR finish - water repellent	Machine wash at 30C; Do not bleach; Do not tumble dry; cool iron on reverse; do not dry clean; do not use biological detergent; wash dark colours separately; do not iron over print	Yes (on the body, not the sleeve)	No PFC policy, some items are la-belled PFC-free, some are not. This one is not.
25	UK-PFAS-03	jacket	UK	Seasons Printed Kids Water Resistant Padded Jacket	Mountain Ware-house	E-shop Blacks	China	Printed padded jacket; colour: mix blue/or-ange/pink;hodd+ 2 side pockets	Shell: Polyester 100%, Lining: Polyester 100%, Filling: Polyester 100%	The Printed Seasons Kids Padded Jacket guarantees a cosy winter. Lightweight microfiber padding for better insulation and made of wa-ter-resistant fabric - it's great for winter outdoor fun. Water-resistant - Treated with Durable Water Repellent (DWR), droplets will bead and roll off the fabric. Light rain, or limited exposure to rain. Padded Insulation - Microfibre filling provides excellent heat retention, a synthetic alternative to down.	Delicate 30C machine wash separately with a wash in re-proofer. Do not bleach. Tumble dry on low heat. Do not iron. Do not dry clean. Do not use soft-ner. Use spray re-proofer after washing to maintain waterproofing. Close zip before washing.	Yes	Berghaus claims it's PFC-free, but they say they moved from C8 to C6. Some items are la-belled PFC-free, some are not. This one is not.
26	UK-PFAS-04	overalls (jacket)	UK	Kids' Charco Waterproof Puddle Suit | Extreme Green Frog	Regatta	E-shop Regatta	Myanmar	Puddle suit with frog design; colour: green; Animal face on hood with ears; Grown on hood; Elasticated waist and cuffs; Reflective trim	100% Polyamide; 100% Polyester mesh lining to hood	Our all-in-one waterproof Charco splash suit with a super cute animal design will bring sunshine to the greyest of days. Made from breathable ISOLITE fabric with a DWR (Durable Water Repel-lent) finish, sealed seams and breeze-blocking around the cuffs. Whether it's a wet weather day at nursery or feeding the ducks in the park, their favourite animal suit will make sure rain doesn't stop play. Waterproof and breathable Isolite lightweight polyamide fabric; Breathability rating 5,000g/m2/24hrs; Durable water repellent finish; Technology: Isolite: Lightweight waterproof, breathable and windproof fabric	Cool machine wash with Ref=gatta Isotex cleaner or pure soap. Do not bleach. Tumble dry on low setting. Do not iron. Do not dry clean. Wash dark colours separately. Store away from direct sunlight. Do not store whilst damp.	No	Not clear if they've fully moved away from PFAS or just C8; no PFC-free la-bel on clothes.

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
27	UK-PFAS-05	overalls (jacket)	UK	Baby Fox Shower Resistant Puddlesuit, Orange	John Lewis	E-shop John Lewis	China	Puddle suit with Fox design; colour: orange	100% polyester; with recycled polyester	A fun and practical choice for outdoor adventures in the rain, our Fox puddlesuit keeps them warm and dry. Crafted in a shower-resistant material, it features long sleeves, a hood and a zip down the front for easy changing. Designed with fox ears and face on the hood, this adorable piece is lightweight and easy to fold away.	Wash on synthetic cycle; wash with similar colours; wash inside out; do not use fabric conditioner	Yes	Impossible to find any PFC/PFAS policy for John Lewis. This sample might be interesting as it's branded sustainable due to the use of recycled polyester.
28	UK-PFAS-06	jacket	UK	Orange Colour Block Waterproof Jacket	George (ASDA)	E-shopAsda	China	Colour block design: Orange and blue; Hooded; Long sleeve; Zip through front fastening; Hook and loop tape fastening; 2 side slip pockets	100% Polyester; Recycled lining - made from old plastic or textiles that's melted down and turned into a whole new fibre; Recycled wadding - made from old plastic bottles or textile waste that's melted down and turned into a whole new fibre.	Waterproof; Shower resistant	30C; wash with similar colour; do not tumble dry; do not use bleach; do not dry clean	No	-
29	UK-PFAS-07	jacket	UK	Blue & Black Waterproof Jacket	Tu (Sainsbury)	E-shop TU/ Sainsburry	China	Blue & black waterproof jacket; With hood; Fleece lining; Internal name tag & hook; Zip fastening with popper overlay; 2 Zipped hand pockets with reflective trim	Main: 100% Polyester, Body & Hood Lining: 100% Polyester, Sleeve Lining: 100% Recycled Polyester, Wadding: 100% Recycled Polyester (Excluding Trims)	This technical jacket with hood and fleece lining is a great option for all-weather. Waterproof, and with zip fastening and popper overlay to trap in the warmth, layer it with a hoodie and cargo trousers for the finishing touch. Waterproof	40C; wash similar colours together; wash garnment inside out; close all fastenings before washing	No	-
30	SL-PFAS-01	t-shirt	Sri Lanka	Sri Lankan Cricket T shirt, original cricket replica	MAS holdings	Fashion Bug, Maradana road, Borella.	Sri Lanka	Sport T shirt for gents, basic colour is blue and containing orange, yellow, red, white, green and maroon colours	100% polyester	With moisture management properties, protection from harmful UV rays of the sun and an anti-microbial finish to keep the players fresh on the field	Machine cold wash with like colours, do not use softners remove immediately, do not allow to lay on itself when wet. do not bleach, tumble dry low cool iron, do not dry clean.	No	-
31	SL-PFAS-02	jacket	Sri Lanka	Mens Jogging set	UMBRO brand	Distributed by Valmistettu/ Sara Lee knit products-Europe	Vietnam	Jogging set with trousers and jacket-black colour and blue colour	Exterior: 100% polyester, lining:100% polyester 100% nylon	-	Turn garment inside out for washing and ironing. wash at or below 30 degrees of Celsius, do not bleach, iron medium temp, dry clean any solvent except Trichloroethylene, do not tumble dry	No	-
32	SL-PFAS-04	jacket	Sri Lanka	Track suit	Adidas OMNI-TECH	House of Fashion, Borella	-	Track suit- black colour with luminus green	-	Stay dry in wet conditions. This multilayer weather protection system keeps outside elements from, in while still allowing moisture vapors to move away from the skin.	-	No	The brand with the 3 stripes
33	SL-PFAS-05	jacket	Sri Lanka	Mens Jacket	S.S.HUSHAN Classic fashion	House of Fashion, Borella	China	Jacket, dark green colour,	polyester fibre 100%	Warning- to avoid danger of suffocation. keep away from babies and children.	Dry cleaning, flat in shade, do not bleach, do not machine wash, do not bleach with CL, mid iron at 150 Celcius, no tumble dry,	No	-

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
34	SL-PFAS-06	apron	Sri Lanka	Apron	Dreamer	House of Fashion, Borella	-	White apron with red butterfly and inscription	-	-	-	No	-
35	SL-PFAS-07	raincoat	Sri Lanka	Rainco	Rainco (Pvt) Limited designed and marketed by:	Prasad Textiles, Homagama	-	Black raincoat	Heavy - gauge polyester PVC	Welded seams for complete protection. Front pockets with flaps. Soft, comfortable and long lasting. Raglan sleeves with wind cuff	Machine wash warm, handwash or machine wash on delicate cycle, no bleach, no dry clean, avoid drying in direct sunlight, tumble dry low, no fabric softener, medium iron	Yes	-
36	TH-PFAS-01	jacket	Thailand	Blue sport softshell jacket	FBT	FBT shop at 4th floor, Sport Mall, The Mall Ngamwongwan, Nonthaburi, Thailand	Thailand	Light and dark blue sport softshell jacket with blue zips	100% Nylon Taffata	-	Hand wash separately, mild detergent, dry in shade, while damp do not iron on prints a appliques	Yes	Creating excellence in sports
37	TH-PFAS-02	shirt	Thailand	Light Blue Shirt	GQ	GQ shop at 4th floor, Sport Mall, The Mall Ngamwongwan, Nonthaburi, Thailand	-	Light blue shirt with water repellent, Men's cotton long sleeve shirt	100% Cotton	Liquid repellent fabric, wrinkle free, cool & breathable, 4-way strech, suitable for any occasion	Machine wash warm, handwash or machine wash on delicate cycle, no bleach, no dry clean, avoid drying in direct sunlight, tumble dry low, no fabric softener, medium iron	Yes	Turn shirt inside out, Wash dry with like colors, Handwash or machine wash on delicate cycle, Air dry or machine tumble dry low, Iron the shirt for extra crispness
38	TH-PFAS-03	t-shirt	Thailand	Light Grey T-shirt	GQ	GQ shop at 4th floor, Sport Mall, The Mall Ngamwongwan, Nonthaburi, Thailand	Thailand	Light grey t-shirt with water repellent	60% Cotton 40% Polyester	Liquid repellent fabric, wrinkle free, cool & breathable, 4-way strech, suitable for any occasion	Machine wash warm, do not use bleach, do not use fabric softene, do not dry clean, tumble dry, do not line dry in sun, medium iron	Yes	-
39	TH-PFAS-04	jacket	Thailand	Light Brown and Thick Softshell jacket	Decathlon	Decathlon shop at 1st floor, Lotus Khaerai, Nonthaburi, Thailand	-	Light brown softshelll jacket with hood	Outer: 100.0% Polyamide (PA) Inner: 100.0% Polyester (PES)	-	Machine wash cold, do not use bleach, do not tumble dry, do not iron, do not dry wash	Yes	-
40	TH-PFAS-05	jacket	Thailand	Light Brown and Thin Softshell Jacket Packable	Muji	Muji shop at 3rd floor, The Mall Ngamwongwan, Nonthaburi, Thailand	-	Light brown softshelll jacket with hood	100% Polyester	Water resistance, UV block SPF50+, packable	Machine wash warm gentle cycle, do not bleach, do not tumble dry, line dry in shape, cool iron, do not dryclean, professional wet-cleaning, use a laundry net, use a press cloth when ironing, do not iron forcefully on the printed pattern	Yes	Ladies' jacket wind block, colour transfer of dark-coloured products may occur during use due to friction and when handling while wet, wash separately, water repellency will gradually get lost by washing or cleaning.
41	TH-PFAS-06	jacket	Thailand	Black Softshell Jacket with Hood	Columbia	Columbia shop at 4th floor, Sport Mall, The Mall Ngamwongwan, Nonthaburi, Thailand	Vietnam	Black softshell jacket with hood and grey zips	Shell: nylon 100% Lining: nylon 100% Mesh lining: polyester 100% Waterproof	Waterproof	Machine wash cold, do not use bleach, tumble dry, cool iron, do not dry wash	Yes	If present close hook and loop fastener, machine wash cold permanent press, powdered detergent, rinse thorougly, wash separately, do not bleach, tumble dry permanent press low, iron low, do not use fabric softener, if present do not iron decal, do not dryclean

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
42	BD-PFAS-01	jacket	Bangla-desh	Softshell Jacket and Water Repellent	Y. Haojin	GAP, Bashundhara City, Panthapath, Dhaka, Bangladesh.	-	Grey softshell jacket for man with Black zips	-	-	-	No	-
43	BD-PFAS-02	hijab	Bangla-desh	Women's Ready Hijab	Al-Modina Borka Hijab	Bashundhara City, Panthapath, Dhaka, Bangladesh.	-	Grey color Ready Hizab	Mix	-	No wringing, light wringing before hanging dry, normal process, shampoo wash, stand steam iron	No	-
44	BD-PFAS-03	trousers	Bangla-desh	Kid's Spiderman costume	Hakuchou, Marvel (Local brand of Thiland)	Mom's angel, Rapa Plaza, 27 dhan-mondi, Dhaka, Bangladesh.	-	Spiderman Costume for boy kid. Red and Black blue color shirt, pant, head mask	Parachute Fabric	-	Do not bleach, should be washed by hand, should not paint, should not soak with colored fabric, should not be used washing machine, no trumble dry, no iron on paint	No	-
45	BD-PFAS-08	jacket	Bangla-desh	MEN'S Jacket 180 L	Grlgimap	GAP, Bashundhara City, Panthapath, Dhaka, Bangladesh.	-	Grey softshell jacket for man with Black zips	-	-	-	No	-
46	BD-PFAS-09	jacket	Bangla-desh	MEN'S Jacket 175 A	Grlgimap	GAP, Bashundhara City, Panthapath, Dhaka, Bangladesh.	-	Moss Green softs-hell jacket for man with Black zips	-	-	-	No	-
47	IN-PFAS-01	jacket	India	Girls Jacket 2x	Quechua - Decathlon	Decathlon Sports India Pvt.Ltd. Sy. No. 78/10 A2, Chikkajala Village Bellary Road, Bangloore - 562157, INDIA Tel: +91-7676798989	-	Jacket sh100 x-warm girl 7-15 y blue	Main fabric 100% polyester.	-	-	No	-
48	IN-PFAS-03	jacket	India	Mens Jacket 2x	Wedze - Decathlon	Lower Ground Floor, A3, Saket Dis-trict Centre, Sector 6, Pushp Vihar, New Delhi, India 110017	-	S ki-p jkt m 100 black old	Main fabric 100% polyester	-	-	Yes	-
49	IN-PFAS-04	swim-suit	India	Swimsuit	Nabaijii - Decathlon	Lower Ground Floor, A3, Saket Dis-trict Centre, Sector 6, Pushp Vihar, New Delhi, India 110017	-	Swimshort 100 basic blue**	Main fabric 100% polyester	-	-	Yes	-
50	IN-PFAS-05	swim-suit	India	Swimsuit	Nabaiji - Aqua resist Decathlon	Decathlon Sports India Pvt.Ltd. Sy. No. 78/10 A2, Chikkajala Village Bellary Road, Bangloore - 562157, INDIA Tel: +91-7676798989	-	Mid jammer 500 yoko black all embo	Main fabric 100% polyester	-	-	No	-
51	IN-PFAS-06	t-shirt	India	CKT. SET	Drimaxx TM	Manfactured and Marketed by: Sanspareils Greenlands, Partapur Meerut- 250103 - India Phone-+91121251478	-	CKT.SET t- shirt, Model: CLUB (Paint+Shirt) JR/ FS/S J	100% polyester	-	Wash dark colours separately, machine/ hand wash, do not bleach tumble dry, low medium iron, soft hand wash, do not iron on prints.	No	-
52	IN-PFAS-07	raincoat	India	Rain Coat	Rainfightter	NZ Seasonal Wear PVT. Ltd. 196, Zeel Estate, Raj Rajeswari Compound, Sonale Village, Kalyan Bhiwandi Road, Bhiwandi, Thane- 421302	-	Rain Coat MENS-WEAR	-	-	-	Yes	-
53	IN-PFAS-08	apron	India	Apron	NISHA	Deepak Store, Shop No., 4160, 4353, Nahargarh Road, 5th, Cross, Near Nimadi Thana- Jaipur- Rajasthan, 302002- India	-	Apron HCA009 NO-3	-	-	-	No	Nisha: Crème Hair Color - No Ammonia
54	IN-PFAS-09	apron	India	Apron	-	Purchased from a shop in Jaipur	-	Apron Black Colour	-	-	-	Yes	-

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
55	IN-PFAS-11	hijab	India	Scarf (Hijab)	-	Street Vendors	-	Black colour	-	-	-	No	-
56	US-PFAS-01	jacket	United States of America	Kid's Jacket	¡XTREME	Fred Meyer	China	Black Colour; Puffy	100% polyester	Water Resistant Outer Shell	-	No, but spread-ing	-
57	US-PFAS-02	jacket	United States of America	Kid's Jacket	¡XTREME	Fred Meyer	China	Black Colour; Puffy	100% polyester	Water Resistant Outer Shell	-	No	-
58	US-PFAS-03	jacket	United States of America	Kid's Soft Shell Jacket	Urban Republic	Fred Meyer	China	Black Colour	100% polyester	Water Resistant	Machine Wash; Dry Flat	Yes	-
59	US-PFAS-04	jacket	United States of America	Kid's Soft Shell Jacket	Urban Republic	Fred Meyer	China	Blue colour	100% polyester	Water Resistant	Machine Wash; Dry Flat	Yes	-
60	US-PFAS-05 outside	jacket	United States of America	Kids' 3-in-1 Jacket	All in Motion	Target	Vietnam	Blue/purple floral pattern	100% polyester	Water Resistant	Machine wash cold with like colors, gentle cycle. Tumble dry low. remove promptly.	No	
62	US-VN-PFAS-01	jacket	United States of America	Women's Flash Insulated Hybrid Hoodie	REI Co-op	REI (purchased online at rei.com)	-	Beachstone gray softshell jacket for women with nylon shell and stretch fleece side panels	Body: 100% Nylon; Side Panels: 85% Nylon, 15% Spandex; Lining: 100% Nylon; Insulation: 100% Polyester	Made in a Fair Trade Certified factory 100% recycled content	Machine wash cold, do not bleach, do not use fabric softeners, tumble dry low, low iron, do not dry clean	Yes	"This jacket's ShadowBaffle construction is up to 14% warmer than standard quilt-through- plus it has move-ment-ready stretch sides."
63	US-CN-PFAS-02	jacket	United States of America	Women's The One Jacket	KUHL	REI (purchased online at rei.com)	-	Poppy colored softshell jacket with black zips	Body fabric: 100% Nylon; Fabric 2: 100% Polyester; Fabric 3: 82% Nylon66, 18% Spandex	Temperature regulating Aero Knit insulation regulates body temperature and releases excess heat"	Machine wash cold, delicate process, do not bleach, tumble dry low, iron low temp. No steam, do not dry clean	No	-
64	US-VN-PFAS-03	jacket	United States of America	Alpine Start Hoodie - Men's	Black Diamond	REI (purchased online at rei.com)	-	Smoke colored softshell jacket	93% Nylon, 7% Elastane	Schoeller Eco-Re-pel Bio PFC-free DWR Technology Bluesign approved material	Machine wash, cold. Do not bleach. Tumble dry, Normal, Low feat. Iron, low. Do not steam. Do not use fabric softener.	No	"SUSTAINABILITY ATTRIBUTES PFC-Free DWR water repellant finish does not contain PFC chemicals; Bluesign approved material primary fabric/material is supplied by a Bluesign approved supply chain" "Schoeller Switzerland: High-function fabrics for humans and the environment. This product contains high-tech fabric from Schoeller Textile AG, a Swiss-based interna-tionally operating company. In cooperation with our global partners, we develop and manufacture high-performance fabrics and textile technologies on the most modern equipment and adhering to the most stringent standards worldwide. Innovation in combination with ecological and social responsibility is the foundation of our business." "ecorepel bio a Schoeller technology (bio-based wa-ter-repelling technology): Water-repelling on the basis of renewable primary products, free from flurocarbons and PFCs, aqueous dirt repellent"

	Sample ID	Sample type	Country	Product name (if any)	Brand	Store	Made in	Product description	Material	Labelling	User instruction	Bead test	Other information from the label
65	US-VN-PFAS-04	jacket	United States of America	Junction Hybrid Cycling Jacket - Men's	REI Co-op	REI (purchased online at rei.com)	Vietnam	-	Front: 91% Nylon, 9% Spandex Back: 90% Polyester, 10% Spandex	Made in a Fair Trade Certified factory Bluesign-certified fabrics Water repellent	Machine wash warm, do not bleach, tumble dry low, cool iron if necessary, do not dry clean	Yes	"With protection in the front, ventilation in the back- & stretch all over- this'll keep you comfy throughout the season."
66	US-ID-PFAS-05	jacket	United States of America	Reversible Mossbud Swirl Insulated Jacket - Girls'	The North Face	REI (purchased online at rei.com)	Indonesia	-	Shell: 100% cotton / Lining: 100% polyester	Heatseeker Eco insulation for warmth even in wet weather Durawble water-repellent finish	Machine wash warm gentle cycle. Wash inside out and separately. Close all fasteners before washing. Wash with mild detergent. Rinse well. Do not bleach. Tumble dry low. Do not iron. Do not dry clean.	No	"Heatseeker Eco is a synthetic insulation made with hollow-core fibers for warmth, performance and durability. Made with 70% post-consumer recycled content."
67	MN-PFAS-01	jacket	Montenegro	Girls Winter jacket	OVS	Delta City Mall, Cetinjski Put, Podgorica 81000	Myanmar	Light pink jacket for girls	100% Polyester	Water resistant	Maximum washing temperature 40°C, do not bleach, temperature max 60°C, iron at maximum sole plate temperature of 110°C, steam ironing may cause irreversible damage, wash inside out, do not use fabric conditioner	-	-
68	MN-PFAS-02	jacket	Montenegro	Girls Winter jacket	De Facto	Extra Retail Park, Podgorica	China	Gold/bronze jacket for girls with black hoodie	100% Polyester	Water repellent, thermal polar lining	Do not wash, do not bleach, do not tumble dry, do not dry clean, do not iron. Keep away from fire.	-	-
69	MN-PFAS-03	jacket	Montenegro	Kids light jacket	Waikiki	LC Waikiki, Shopping center HDL, 4. jula bb, 81000	China	Light blue jacket for boys with hoodie	100% Polyester	Water repellent, windproof	Keep away from fire. Wash separately or with similar colours inside out, do not keep wet.	-	-
70	KE-CO-01	trousers	Kenya	Men trousers L	Jack Wolfskin	Bough on the open market- second hand	Vietnam	-	100% polyamide with polyurethane coating	-	Wash at 30 C with similar colors, wash inside out, close all zips and fasterners, do not use softeners, do not iron printed area	No	Used (probably second hand) purchase
71	KE-CO-02	gloves	Kenya	Black gloves	No brand	Bough on the open market- second hand	China	-	Shell: 90% Polyester, 10% PVC, Lining: 100% Polyester	-	Hand wash, do not bleach, do not iron, line dry, hang to dry	Yes	Used (probably second hand) purchase
72	KE-CO-03	jacket	Kenya	Jacket L	REI boys	Bough on the open market- second hand	Vietnam	-	Shell: 100% Nylon, collar facing: 100% polyester	-	Mashine wash cold, do not bleach, tumble dry low, cool iron if necessary, secure all zippers and closures, do not dry clean	Yes	Used, signed Sam Budd Fleetwood school
73	KE-CO-04	jacket	Kenya	Jacket XL	Eddie Bauer	Bough on the open market- second hand	Bangladesh	-	Shell: 100% Nylon (Polyamid)	-	Mashine wash 40C warm, delicate cycle, separately, secure all garments closures before laundering, use mild detergents, rinse thoroughly, do not bleach, do not use fabric softeners, tumble dry low, do not iron, do not dry clean	Yes	Used (probably second hand) purchase

Annex 3-B: Sample photos

1 **CZ- OUTD-01A**

2 **CZ- OUTD-02A**

3 **CZ- OUTD-03A**

4 **CZ- OUTD-04A**

5 **CZ- OUTD-05A**

6 **CZ- OUTD-06A**

7 **CZ- OUTD-07A**

8 **CZ- OUTD-08A**

9 **CZ- OUTD-09A**

10 **CZ- OUTD-10A**

11 **RS-PFAS-01**

12 **RS-PFAS-02**

13 **RS-PFAS-03**

14 **RS-PFAS-04**

15 **NL-PFAS-01**

16 **NL-PFAS-02**

17 **NL-PFAS-03**

18 **NL-PFAS-04**

19 **PL-PFAS-01**

20 **PL-PFAS-02**

21 **DE-PFAS-01**

22 **DE-PFAS-02**

23 **UK-PFAS-01**

24 **UK-PFAS-02**

25 **UK-PFAS-03**

26 **UK-PFAS-04**

27 **UK-PFAS-05**

28 **UK-PFAS-06**

29 **UK-PFAS-07**

30 **SL-PFAS-01**

31 **SL-PFAS-02**

32 **SL-PFAS-04**

33 **SL-PFAS-05**

34 **SL-PFAS-06**

35 **SL-PFAS-07**

36 **TH-PFAS-01**

37 **TH-PFAS-02**

38 **TH-PFAS-03**

39 **TH-PFAS-04**

40 **TH-PFAS-05**

41 **TH-PFAS-06**

42 **BD-PFAS-01**

43 **BD-PFAS-02**

44 **BD-PFAS-03**

45 **BD-PFAS-08**

46 **BD-PFAS-09**

47 **IN-PFAS-01**

48 **IN-PFAS-03**

49 **IN-PFAS-04**

50 **IN-PFAS-05**

51 **IN-PFAS-06**

52 **IN-PFAS-07**

53 **IN-PFAS-08**

54 **IN-PFAS-09**

55 **IN-PFAS-11**

56 **US-PFAS-01**

57 **US-PFAS-02**

58 **US-PFAS-03**

59 **US-PFAS-04**

60 **US-PFAS-05 outside**

62 **US-VN-PFAS-01**

63 **US-CN-PFAS-02**

64 **US-VN-PFAS-03**

65 **US-VN-PFAS-04**

66 **US-ID-PFAS-05**

67 **MN-PFAS-01**

68 **MN-PFAS-02**

69 **MN-PFAS-03**

70 **KE-CO 1**

71 **KE-CO 2**

72 **KE-CO 3**

73 **KE-CO 4**

Annex 4
Methods for detection and quantification of PFAS

EXTRACTABLE ORGANIC FLUORINE (EOF)

Organic fluorine in sample extracts (EOF; extractable organic fluorine) was determined by combustion ion chromatography (CIC). In this procedure, the sample is burned at 1000°C in an atmosphere of oxygen and argon and the organically bound fluorine is gassed and trapped in an aqueous peroxide solution as fluoride. Finally, the concentration of fluoride is determined by ion chromatography and the amount of fluoride is related to the area of the fabric analysed as in the case of targeted analysis.

TARGET ANALYSIS OF 58 PFAS

Fifty-eight targeted PFAS (See Annex 1 listing targeted PFAS and their LOD/LOQs) in sample extracts were determined using high-performance liquid chromatography with tandem mass detection with electrospray ionisation operating in negative mode (HPLC-ESI-MS/MS), the substances of interest were quantified and the amount determined in the extract was converted to the area of the fabric analysed.

Annex 5: Lab results (ng/g)

Waikiki · The North Face · Husky · GRLGIMAP · Decathlon · Columbia · GQ

#Photo	Sample ID	Sample type	EOF	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFHxS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Sum of individual PFAS
1	**CZ- OUTD-01A**	jacket	109 530.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
2	**CZ- OUTD-02A**	jacket	36 038.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	226.6	<LOD	<LOD	<LOD	<LOD	<LOD	226.6
3	**CZ- OUTD-03A**	jacket	9 213.6	1.5	0.4	2.6	4.6	2.7	0.8	1.4	<LOD	<LOD	<LOD	39.9	<LOD	<LOD	<LOD	<LOD	<LOD	54.1
4	**CZ- OUTD-04A**	**jacket**	4 253.7	1.8	1.5	7.6	1.6	2.4	0.5	0.9	<LOD	<LOD	<LOD	50.4	<LOD	<LOD	<LOD	<LOD	<LOD	66.8
5	**CZ- OUTD-05A**	**jacket**	15 782.4	5.7	2.8	29.2	23.9	17.1	5.4	7.1	1.9	<LOD	<LOD	284.7	<LOD	<LOD	<LOD	<LOD	<LOD	377.9
6	**CZ- OUTD-06A**	jacket	73 357.8	5.2	4.8	49.8	61.9	63.2	19.0	38.8	6.0	<LOD	<LOD	193.2	<LOD	<LOD	<LOD	<LOD	<LOD	441.9
7	**CZ- OUTD-07A**	jacket	3 934.5	<LOD	<LOD	1.9	2.0	<LOD	0.6	<LOD	<LOD	<LOD	793.8	26.8	<LOD	<LOD	<LOD	<LOD	<LOD	825.1
8	**CZ- OUTD-08A**	jacket	45 129.3	<LOD	<LOD	8.9	<LOD	<LOD	<LOD	4.3	<LOD	<LOD	1 070.5	221.0	<LOD	<LOD	<LOD	<LOD	<LOD	1304.7
9	**CZ- OUTD-09A**	jacket	5 435.7	<LOD	<LOD	3.8	<LOD	1.1	<LOD	<LOD	<LOD	<LOD	<LOD	63.7	<LOD	24.9	<LOD	<LOD	<LOD	93.5
10	**CZ- OUTD-10A**	jacket	5 905.8	7.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	7.9
11	**RS-PFAS-01**	**jacket**	<LOD	9.0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	9.0
12	**RS-PFAS-02**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
13	**RS-PFAS-03**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
14	**RS-PFAS-04**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
15	**NL-PFAS-01**	**jacket**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
16	**NL-PFAS-02**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
17	**NL-PFAS-03**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
18	**NL-PFAS-04**	jacket	<LOD	<LOD	<LOD	5.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	5.7

#Photo	Sample ID	Sample type	EOF	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFHxS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Sum of individual PFAS
19	**PL-PFAS-01**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
20	**PL-PFAS-02**	**jacket**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
21	**DE-PFAS-01**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
22	**DE-PFAS-02**	jacket	<LOD	<LOD	<LOD	2.6	<LOD	2.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	4.9
23	**UK-PFAS-01**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
24	**UK-PFAS-02**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
25	**UK-PFAS-03**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	765.1	<LOD	<LOD	<LOD	<LOD	<LOD	765.1
26	**UK-PFAS-04**	overalls	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
27	**UK-PFAS-05**	overalls	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
28	**UK-PFAS-06**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
29	**UK-PFAS-07**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
30	**SL-PFAS-01**	t-shirt	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
31	**SL-PFAS-02**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
32	**SL-PFAS-04**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
33	**SL-PFAS-05**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
34	**SL-PFAS-06**	apron	<LOD	<LOD	<LOD	<LOD	<LOD	2.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	2.7
35	**SL-PFAS-07**	raincoat	<LOD	<LOD	<LOD	<LOD	<LOD	2.6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	2.6
36	**TH-PFAS-01**	jacket	<LOD	<LOD	<LOD	18.9	<LOD	13.0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	31.9
37	**TH-PFAS-02**	**shirt**	<LOD	6.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	6.5
38	**TH-PFAS-03**	**t-shirt**	1 875.8	18.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**361.8**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	379.9
39	**TH-PFAS-04**	**jacket**	3 272.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
40	**TH-PFAS-05**	**jacket**	15 326.6	20.2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	20.2

#Photo	Sample ID	Sample type	EOF	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFHxS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Sum of individual PFAS
41	TH-PFAS-06	jacket	2 144.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
42	BD-PFAS-01	jacket	602.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
43	BD-PFAS-02	hijab	770.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
44	BD-PFAS-03	trousers	445.3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
45	BD-PFAS-08	jacket	251.3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
46	BD-PFAS-09	jacket	263.2	<LOD	<LOD	6.8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	6.8
47	IN-PFAS-01	jacket	384.8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
48	IN-PFAS-03	jacket	2 632.4	3.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	3.4
49	IN-PFAS-04	swimsuit	9 624.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	702.2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	702.2
50	IN-PFAS-05	swimsuit	367.8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
51	IN-PFAS-06	t-shirt	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
52	IN-PFAS-07	raincoat	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
53	IN-PFAS-08	apron	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
54	IN-PFAS-09	apron	555.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
55	IN-PFAS-11	hijab	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
56	US-PFAS-01	jacket	603.2	<LOD	<LOD	<LOD	<LOD	11.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	11.4
57	US-PFAS-02	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	17.0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	17.0
58	US-PFAS-03	jacket	685.2	<LOD	<LOD	2.7	<LOD	1.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	3.8
59	US-PFAS-04	jacket	687.9	<LOD	<LOD	3.0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	114.1	<LOD	<LOD	<LOD	<LOD	<LOD	117.1
60	US-PFAS-05 outside	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	12.6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	12.6
62	US-VN-PFAS-01	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
63	US-CN-PFAS-02	jacket	8 409.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

#Photo	Sample ID	Sample type	EOF	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFTrDA	PFHxS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Sum of individual PFAS
64	**US-VN-PFAS-03**	jacket	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
65	**US-VN-PFAS-04**	jacket	10 253.4	7.3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	975.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	983.0
66	**US-ID-PFAS-05**	**jacket**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
67	**MN-PFAS-01**	jacket	424.6	<LOD	<LOD	17.5	<LOD	6.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	24.1
68	**MN-PFAS-02**	jacket	2 907.9	<LOD	<LOD	6.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	6.1
69	MN-PFAS-03	jacket	1 779.3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
70	**KE-CO 1**	trousers	5 081.1	19.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	10.0	<LOD	<LOD	<LOD	<LOD	11.3	6.7	<LOD	47.6
71	**KE-CO 2**	gloves	1 164.7	<LOD	<LOD	<LOD	<LOD	11.5	<LOD	<LOD	<LOD	<LOD	<LOD	348.0	66.1	<LOD	6.8	<LOD	<LOD	432.5
72	**KE-CO 3**	jacket	225 343.2	172.3	7.9	26.4	<LOD	14.1	<LOD	<LOD	<LOD	6.9	<LOD	<LOD	<LOD	<LOD	10.2	7.3	6.6	251.8
73	**KE-CO 4**	jacket	545 667.7	76.7	14.1	52.8	<LOD	25.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	148.2	108.5	100.6	526.5

References

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. Cousins, I.T., et al., *The concept of essential use for determining when uses of PFASs can be phased out.* Environ Sci Process Impacts, 2019. **21**(11): p. 1803-1815.
3. Szilagyi, J.T., V. Avula, and R.C. Fry, *Perfluoroalkyl Substances (PFAS) and Their Effects on the Placenta, Pregnancy, and Child Development: a Potential Mechanistic Role for Placental Peroxisome Proliferator–Activated Receptors (PPARs).* Current Environmental Health Reports, 2020. **7**(3): p. 222-230.
4. Kim, M.J., et al., *Association between perfluoroalkyl substances exposure and thyroid function in adults: A meta-analysis.* PLoS One, 2018. **13**(5): p. e0197244.
5. Caron-Beaudoin, E., et al., *Exposure to perfluoroalkyl substances (PFAS) and associations with thyroid parameters in First Nation children and youth from Quebec.* Environ Int, 2019. **128**: p. 13-23.
6. Chang, E.T., et al., *A critical review of perfluorooctanoate and perfluorooctanesulfonate exposure and immunological health conditions in humans.* Critical Reviews in Toxicology, 2016. **46**(4): p. 279-331.
7. Grandjean, P., et al., *Estimated exposures to perfluorinated compounds in infancy predict attenuated vaccine antibody concentrations at age 5-years.* J Immunotoxicol, 2017. **14**(1): p. 188-195.
8. Looker, C., et al., *Influenza Vaccine Response in Adults Exposed to Perfluorooctanoate and Perfluorooctanesulfonate.* Toxicological Sciences, 2014. **138**(1): p. 76-88.
9. Grandjean, P., et al., *Severity of COVID-19 at elevated exposure to perfluorinated alkylates.* PLoS One, 2020. **15**(12): p. e0244815.
10. Cornelsen, M., R. Weber, and S. Panglisch, *Minimizing the environmental impact of PFAS by using specialized coagulants for the treatment of PFAS polluted waters and for the decontamination of firefighting equipment.* Emerging Contaminants, 2021. **7**: p. 63-76.
11. Heydebreck, F., et al., *Emissions of per-and polyfluoroalkyl substances in a textile manufacturing plant in China and their relevance for workers' exposure.* Environmental science & technology, 2016. **50**(19): p. 10386-10396.
12. Langberg, H.A., et al., *Paper product production identified as the main source of per- and polyfluoroalkyl substances (PFAS) in a Norwegian lake: Source and historic emission tracking.* Environ Pollut, 2020. **273**: p. 116259.
13. Kotthoff, M., et al., *Perfluoroalkyl and polyfluoroalkyl substances in consumer products.* Environ Sci Pollut Res Int, 2015. **22**(19): p. 14546-59.
14. Masoner, J.R., et al., *Landfill leachate contributes per-/poly-fluoroalkyl substances (PFAS) and pharmaceuticals to municipal wastewater.* Environmental Science: Water Research & Technology, 2020. **6**(5): p. 1300-1311.
15. Huber, S., et al., *Emissions from incineration of fluoropolymer materials - A literature survey.* 2009.
16. Kotthoff, M. and M. Bucking, *Four Chemical Trends Will Shape the Next Decade's Directions in Perfluoroalkyl and Polyfluoroalkyl Substances Research.* Front Chem, 2018. **6**: p. 103.
17. Cousins, I.T., et al., *Strategies for grouping per- and polyfluoroalkyl substances (PFAS) to protect human and environmental health.* Environ Sci Process Impacts, 2020. **22**(7): p. 1444-1460.
18. Rauert, C., et al., *Atmospheric concentrations and trends of poly- and perfluoroalkyl substances (PFAS) and volatile methyl siloxanes (VMS) over 7 years of sampling in the Global Atmospheric Passive Sampling (GAPS) network.* Environ Pollut, 2018. **238**: p. 94-102.
19. Brusseau, M.L., R.H. Anderson, and B. Guo, *PFAS concentrations in soils: Background levels versus contaminated sites.* Science of The Total Environment, 2020. **740**: p. 140017.
20. Podder, A., et al., *Per and poly-fluoroalkyl substances (PFAS) as a contaminant of emerging concern in surface water: A transboundary review of their occurrences and toxicity effects.* Journal of Hazardous Materials, 2021. **419**: p. 126361.
21. Hu, X.C., et al., *Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants.* Environmental Science & Technology Letters, 2016.
22. Karaskova, P., et al., *Perfluorinated alkyl substances (PFASs) in household dust in Central Europe and North America.* Environ Int, 2016. **94**: p. 315-324.
23. Young, A.S., et al., *Assessing Indoor Dust Interference with Human Nuclear Hormone Receptors in Cell-Based Luciferase Reporter Assays.* Environ Health Perspect, 2021. **129**(4): p. 47010.

24. Lin, Y., et al., *Perfluoroalkyl substances in sediments from the Bering Sea to the western Arctic: Source and pathway analysis.* Environ Int, 2020. **139**: p. 105699.
25. Rotander, A., et al., *Levels of perfluorinated chemicals (PFCs) in marine mammals in Arctic areas of the nordic countries during three decades (1984-2007).* Organohalogen Compounds, 2010. **72**.
26. De Silva, A.O., et al., *PFAS Exposure Pathways for Humans and Wildlife: A Synthesis of Current Knowledge and Key Gaps in Understanding.* Environ Toxicol Chem, 2020.
27. Tao, L., et al., *Perfluorinated Compounds in Human Breast Milk from Several Asian Countries, and in Infant Formula and Dairy Milk from the United States.* Environmental Science & Technology, 2008. **42**(22): p. 8597-8602.
28. Ingelido, A.M., et al., *Serum concentrations of perfluorinated alkyl substances in farmers living in areas affected by water contamination in the Veneto Region (Northern Italy).* Environment International, 2020. **136**: p. 105435.
29. Gockener, B., et al., *Human biomonitoring of per- and polyfluoroalkyl substances in German blood plasma samples from 1982 to 2019.* Environ Int, 2020. **145**: p. 106123.
30. Worley, R.R., et al., *Per- and polyfluoroalkyl substances in human serum and urine samples from a residentially exposed community.* Environment International, 2017. **106**: p. 135-143.
31. Zheng, G., et al., *Per-and polyfluoroalkyl substances (PFAS) in breast milk: concerning trends for current-use PFAS.* Environmental science & technology, 2021. **55**(11): p. 7510-7520.
32. Agency, T.D.E.P., *Polyfluoroalkyl substances (PFASs) in textiles for children.* 2015.
33. Hill, P.J., et al., *Substitution of PFAS chemistry in outdoor apparel and the impact on repellency performance.* Chemosphere, 2017. **181**: p. 500-507.
34. Schellenberger, S., et al., *Highly fluorinated chemicals in functional textiles can be replaced by re-evaluating liquid repellency and end-user requirements.* Journal of cleaner production, 2019. **217**: p. 134-143.
35. Lu, C., et al., *Perfluorinated compounds in blood of textile workers and barbers.* Chinese Chemical Letters, 2014. **25**(8): p. 1145-1148.
36. Schellenberger, S., et al., *Release of Side-Chain Fluorinated Polymer-Containing Microplastic Fibers from Functional Textiles During Washing and First Estimates of Perfluoroalkyl Acid Emissions.* Environ Sci Technol, 2019. **53**(24): p. 14329-14338.
37. Schellenberger, S., et al., *An Outdoor Aging Study to Investigate the Release of Per- And Polyfluoroalkyl Substances (PFAS) from Functional Textiles.* Environ Sci Technol, 2022. **56**(6): p. 3471-3479.
38. Schlummer, M., et al., *Detection of fluorotelomer alcohols in indoor environments and their relevance for human exposure.* Environ Int, 2013. **57-58**: p. 42-9.
39. Lenka, S.P., M. Kah, and L.P. Padhye, *A review of the occurrence, transformation, and removal of poly- and perfluoroalkyl substances (PFAS) in wastewater treatment plants.* Water Research, 2021. **199**: p. 117187.
40. Stoiber, T., S. Evans, and O.V. Naidenko, *Disposal of products and materials containing per- and polyfluoroalkyl substances (PFAS): A cyclical problem.* Chemosphere, 2020. **260**: p. 127659.
41. National Academies of Sciences, E. and Medicine, *Guidance on PFAS Exposure, Testing, and Clinical Follow-Up*. 2022, Washington, DC: The National Academies Press. 300.
42. Brendel, S., et al., *Short-chain perfluoroalkyl acids: environmental concerns and a regulatory strategy under REACH.* Environmental Sciences Europe, 2018. **30**(1): p. 1-11.
43. Li, F., et al., *Short-chain per-and polyfluoroalkyl substances in aquatic systems: Occurrence, impacts and treatment.* Chemical Engineering Journal, 2020. **380**: p. 122506.
44. Lucas, K., et al., *Occupational exposure and serum levels of per-and polyfluoroalkyl substances (PFAS): A review.* American Journal of Industrial Medicine, 2023. **66**(5): p. 379-392.
45. Fábelová, L., et al., *PFAS levels and exposure determinants in sensitive population groups.* Chemosphere, 2023. **313**: p. 137530.
46. De Silva, A.O., et al., *PFAS exposure pathways for humans and wildlife: a synthesis of current knowledge and key gaps in understanding.* Environmental toxicology and chemistry, 2021. **40**(3): p. 631-657.
47. Ragnarsdóttir, O., M.A.-E. Abdallah, and S. Harrad, *Dermal uptake: An important pathway of human exposure to perfluoroalkyl substances?* Environmental Pollution, 2022. **307**: p. 119478.
48. Vuong, A.M., et al., *Prenatal and childhood exposure to poly-and perfluoroalkyl substances (PFAS) and cognitive development in children at age 8 years.* Environmental research, 2019. **172**: p. 242-248.
49. Rappazzo, K.M., E. Coffman, and E.P. Hines, *Exposure to perfluorinated alkyl substances and health outcomes in children: a systematic review of the epidemiologic literature.* International journal of environmental research and public health, 2017. **14**(7): p. 691.
50. von Holst, H., et al., *Perfluoroalkyl substances exposure and immunity, allergic response, infection, and asthma in children: review of epidemiologic studies.* Heliyon, 2021. **7**(10).
51. Geiger, S.D., et al., *PFAS exposure and overweight/ obesity among children in a nationally representative sample.* Chemosphere, 2021. **268**: p. 128852.

52. Lee, Y.J., et al., *Early-life exposure to per-and poly-fluorinated alkyl substances and growth, adiposity, and puberty in children: a systematic review.* Frontiers in endocrinology, 2021. **12**: p. 683297.

53. Harris, M.H., et al., *Prenatal and childhood exposure to per-and polyfluoroalkyl substances (PFAS) and child executive function and behavioral problems.* Environmental Research, 2021. **202**: p. 111621.

54. Huang, M.C., et al., *Toxicokinetics of 8:2 fluorotelomer alcohol (8:2-FTOH) in male and female Hsd:Sprague Dawley SD rats after intravenous and gavage administration.* Toxicol Rep, 2019. **6**: p. 924-932.

55. 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.

56. O'Connor, J.C., et al., *Evaluation of the reproductive and developmental toxicity of 6: 2 fluorotelomer alcohol in rats.* Toxicology, 2014. **317**: p. 6-16.

57. Gebbink, W.A., et al., *Polyfluoroalkyl phosphate esters and perfluoroalkyl carboxylic acids in target food samples and packaging--method development and screening.* Environ Sci Pollut Res Int, 2013. **20**(11): p. 7949-58.

58. Ao, J., et al., *Polyfluoroalkyl phosphate esters (PAPs) as PFAS substitutes and precursors: An overview.* Journal of Hazardous Materials, 2024. **464**: p. 133018.

59. Chen, P., et al., *Thyroid-disrupting effects of 6: 2 and 8: 2 polyfluoroalkyl phosphate diester (diPAPs) at environmentally relevant concentrations from integrated in silico and in vivo studies.* Environmental Science & Technology Letters, 2020. **7**(5): p. 330-336.

60. Luo, K., et al., *Environmental Exposure to 6:2 Polyfluoroalkyl Phosphate Diester and Impaired Testicular Function in Men.* Environmental Science & Technology, 2022. **56**(12): p. 8290-8298.

61. Manshoven, S., et al., *Plastic in textiles: potentials for circularity and reduced environmental and climate impacts*, in *Eionet Report - ETC/WMGE 2021/1*. 2021. p. 49.

62. Mühle, J., et al., *Perfluorocyclobutane (PFC-318) in the global atmosphere.* Atmospheric Chemistry and Physics, 2019. **19**(15): p. 10335-10359.

63. Liagkouridis, I., et al., *Combined use of total fluorine and oxidative fingerprinting for quantitative determination of side-chain fluorinated polymers in textiles.* Environmental Science & Technology Letters, 2021. **9**(1): p. 30-36.

64. Li, L., et al., *Degradation of fluorotelomer-based polymers contributes to the global occurrence of fluorotelomer alcohol and perfluoroalkyl carboxylates: A combined dynamic substance flow and environmental fate modeling analysis.* Environmental Science & Technology, 2017. **51**(8): p. 4461-4470.

65. Washington, J.W., et al., *Decades-scale degradation of commercial, side-chain, fluorotelomer-based polymers in soils and water.* Environ Sci Technol, 2015. **49**(2): p. 915-23.

66. van der Veen, I., et al., *The effect of weathering on per- and polyfluoroalkyl substances (PFASs) from durable water repellent (DWR) clothing.* Chemosphere, 2020. **249**: p. 126100.

67. Gockener, B., et al., *Exploring unknown per- and polyfluoroalkyl substances in the German environment - The total oxidizable precursor assay as helpful tool in research and regulation.* Sci Total Environ, 2021. **782**: p. 146825.

68. Casson, R. and S.-Y.D. Chiang, *Integrating total oxidizable precursor assay data to evaluate fate and transport of PFASs.* Remediation Journal, 2018. **28**(2): p. 71-87.

69. Robel, A.E., et al., *Closing the mass balance on fluorine on papers and textiles.* Environmental science & technology, 2017. **51**(16): p. 9022-9032.

70. Le, K., *Textile recycling technologies, colouring and finishing methods.* Solid Waste Services. Vancoover, 2018: p. 23-50.

71. Fernandes, A., et al., *The potential of recycled materials used in agriculture to contaminate food through uptake by livestock.* Science of the Total Environment, 2019. **667**: p. 359-370.

72. Fernandes, A.R., et al., *The transfer of environmental contaminants (Brominated and Chlorinated dioxins and biphenyls, PBDEs, HBCDDs, PCNs and PFAS) from recycled materials used for bedding to the eggs and tissues of chickens.* Science of The Total Environment, 2023. **892**: p. 164441.

73. Bell, L., *Chemical recycling: a dangerous deception.* Beyond Plastics and International Pollutants Elimination Network (IPEN), 2023: p. 158.

74. Takada, H. and L. Bell, *Plastic Waste Management Hazards.* INternational Pollutants Elimination Network (IPEN), 2021: p. 113.

75. Östlund, Å., et al., *Textilåtervinning: Tekniska möjligheter och utmaningar.* 2015: Naturvårdsverket.

76. Cousins, I.T., et al., *The high persistence of PFAS is sufficient for their management as a chemical class.* Environ Sci Process Impacts, 2020. **22**(12): p. 2307-2312.

© Arnika and IPEN 2023

ISBN 978-80-11-04187-8