FOREVER CHEMICALS IN SINGLE-USE FOOD PACKAGING AND TABLEWARE FROM 17 COUNTRIES

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ABBREVIATIONS

CAS - Chemical Abstracts Service
CIC - Combustion ion chromatography
EE – Eastern Europe
ECHA - European Chemicals Agency
EOF - Extractable organic fluorine
ESM - Environmentally sound management
EU - European Union
FTOHs - Fluorotelomer alcohols
H11 - Delayed or chronic toxicity
MENA – Middle East and North Africa
NGO - Non-governmental organization
OECD - Organisation for Economic Co-operation and Development
PAPs - Polyfluorinated alkyl phosphate esters
PFAS - Per- and polyfluoroalkyl substances
PFCAs - Perflurocarboxylic acids
POPs - Persistent organic pollutants
REACH- Registration, Evaluation, Authorisation and Restriction of Chemicals
SA/EA/SE - South, East, and South-East Asia
SFPs - Side-chain fluorinated polymers
SVHCs - Substances of very high concern
PRC - People's Republic of China
TOF - Total Organic Fluorine
US - United States

Chemical names, CAS numbers, and limits of quantification (LOQs) of 58 PFAS analyzed in this study are presented in Annex 1.

CONTENTS

ABSTRACT

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. PFAS are commonly used by paper-, pulp, and molded fiber industry for producing disposable grease- and water-resistant food packaging and tableware items. Due to their grease-resistance properties, PFAS are widely used in baking paper and cupcake cups, bakery bags, fast-food and take-away containers, microwave popcorn bags, and compostable tableware. Generally, no information is provided about PFAS content in these types of products.

This study was conducted to assess PFAS use and unintentional contamination in paper, cardboard, and plant-based food packaging and tableware from 17 countries across Asia, Africa, Europe, Latin America and the Caribbean, and to contribute to the achievement of the universal ban of all PFAS internationally. 119 samples of food packing (including fast-food wrappers, cardboard boxes for take-away, bags for microwave popcorn, single-use plant-based tableware and boxes for take-away, baking papers, coffee cups, or packaging for non-greasy food from recycled paper) were tested for the presence of PFAS. Extractable organic fluorine (EOF) was used to determine the total amount of PFAS that could be extracted from the samples. 21 out of 58 targeted PFAS were detected and quantified.

The results showed that 64 of 119 samples (54%) contained PFAS, including fast-food packaging from major fast food chains. PFAS are known to migrate from food packaging into food and consumption of food that was packed in PFAS-treated paper, i.e., microwave popcorn and meals from fast-food/pizza restaurants, has been shown to be associated with PFAS levels in human blood. The popularity of fast-food consumption, especially among youth, raises concerns regarding the contribution of food packaging to PFAS exposure during crucial times of development. Disposable and single-use items are also of particular concern when it comes to environmental contamination potential due to their high volumes and turnover rates.

Viable alternatives to PFAS-treated paper and cardboard food contact materials exist and are already in use. Several samples from every tested product category in this study contained no targeted PFAS or no extractable organic fluorine (EOF).

Setting legislative thresholds for a few small groups of PFAS is not sufficient to control these harmful substances in food packaging. Only a universal ban, including polymeric PFAS, can stop human exposure and release from food packaging. Therefore, the most efficient control measure for reducing the release of PFAS into the environment and for avoiding hazardous (so-called "regrettable") PFAS substitutes is to have a complete global ban by the Stockholm Convention and national governments no later than 2030.

KEY FINDINGS

- PFAS are widely used, highly toxic chemicals linked to negative impacts on fertility, fetal development, and thyroid hormone function. Increasing evidence indicates that PFAS are endocrine disruptors - chemicals that mimic or interfere with the body's natural hormones.
- The study tested 119 samples of single-use food packaging and tableware collected from 17 countries across Asia, Africa, Europe, Latin America and the Caribbean.
- Samples containing PFAS were identified across geographic regions with the Middle East and North Africa region having the highest share.
- 64 out of 119 analyzed samples (54%) contained PFAS.
- 4 samples contained PFAS above EU limits for PFOA (25 ppb) and/or for long-chain PFCAs (25ppb for the sum of C9-C14 PFCAs).
- 53 samples contained Extractable Organic Fluorine or individual PFAS above the proposed limits in the EU REACH universal restriction.
- The highest PFAS concentrations were consistently found in plant-based molded fiber products (e.g. bowls, plates, and food boxes) advertised as biodegradable or compostable.
- Microwave popcorn bags most frequently contained PFAS (24 out 28 samples).
- 4 out of 12 samples of paper packaging for non-greasy food made of recycled paper were contaminated with PFAS. Therefore, recycling PFAS-treated paper leads to uncontrolled exposure to these forever chemicals, without any possibility of tracing their presence in recycled materials.
- Of the 21 PFAS identified in the analyzed packaging and single-use tableware, 6:2 FTOH was most frequent and 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.
- 98% or more of the PFAS content of the samples remains unidentified, since only a maximum of 2% could be verified as specific PFAS identified via targeted analysis.

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 food packaging, in non-stick cookware, as well as waterproof rain gear and firefighting foams. However, most of the PFAS uses are not essential for the functioning of society and/or have safer alternatives [2].**

PFAS have been shown to be associated with a range of negative health impacts, including negative impacts on fertility, fetal development [3] and thyroid hormone function [4, 5]. Increasing evidence is emerging indicating that PFAS, including PFAS used in food packaging, are endocrine disruptors, chemicals that mimic or interfere with the body's hormones [6]. 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 [7-9] have been highlighted in the context of the Covid-19 pandemic. Also, elevated levels of PFAS in blood were found to be associated with an increased risk of a more severe Covid-19 infection [10].

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 [11-13], use [14], and disposal [15, 16]. This and their persistence lead to continuously increasing concentrations of PFAS in the environment [17, 18]. PFAS were detected in the air [19], soil [20], water [21] including drinking water sources [22], and household dust [23, 24]. When released, they can disperse over long distances and can be found far from the places of their origin, including in the Arctic [25, 26].

PFAS USE IN PAPER, CARDBOARD, AND MOLDED FIBER

PFAS are commonly used by the paper- and pulp industry for producing disposable grease- and water-resistant food packaging and tableware items. PFAS can be added to the pulp or applied as coatings on the surface of paper or cardboard [27, 28]. They are also used in the production of molded plant fiber packaging [29, 30]. The perceived added value of PFAS comes from the fact that they create a chemical barrier on the surface of the wrapping material, which repels the grease coming from the food [31]. This grease-resistant function makes PFAS widely used in baking paper and cupcake cups, bakery bags, fast-food and take-away containers, microwave popcorn bags, and compostable tableware.

However, very limited information is available on the composition and concentrations of specific PFAS used in food contact materials. This poses challenges for assessing toxicity, exposure, and risk to humans [6, 32].

The life cycle of PFAS in paper, molded plant fiber food packaging and tableware is associated with PFAS emissions at every stage, which is concerning considering the high turnover rates of fast-food packaging and disposable tableware. Vegetable parchment or application of starch has been reported as cost-effective alternatives to PFAS treatment of disposable paper and cardboard food packaging [28, 33, 34].

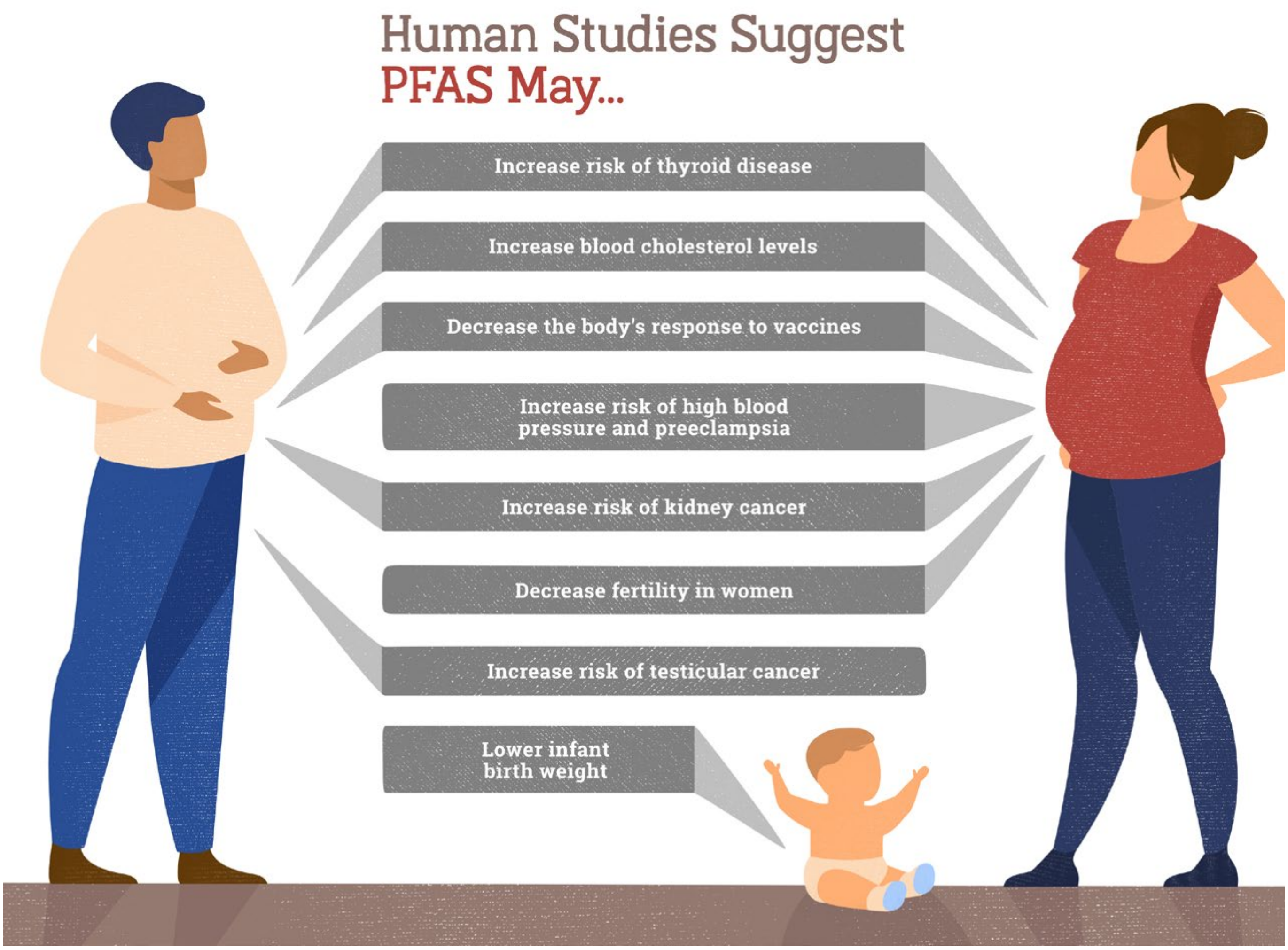
PFAS MIGRATION FROM FOOD AND HUMAN EXPOSURE AND HEALTH

Humans are continuously exposed to PFAS from a wide range of sources. Food and drinking water have been established as the main exposure routes to PFAS. PFAS have been found in a variety of foods including fish, seafood, meat and meat products, and microwaveable popcorn [35-37]. Exposures from dust, indoor environments, and personal care and consumer products are also important [38]. Recent research demonstrates that migration of PFAS from packaging into food is an important contributor to human exposures [39-41].

PFAS migration from food packaging to food increases with higher temperatures of the food-contact material, longer contact time, and the use of emulsifiers [39, 42]. Nevertheless, even long-term storing of dry food (cereal, rice, milk powder) in packaging materials was shown to be linked with PFAS migration to the stored food [42].

Consumption of food packed in PFAS-treated paper, i.e., popcorn and meals from fast food/pizza restaurants, is associated with PFAS levels in human blood. The popularity of fast-food consumption, especially among youth, raises concerns regarding the contribution of food packaging to PFAS exposures during crucial times of development. This also adds to the existing dietary exposures caused by consumption of food and water that is contaminated with PFAS and other persistent pollutants [41-44].

PFAS can be readily absorbed by the intestine and enter the circulatory system or accumulate directly at intestinal sites, which could interact with the intestine and cause the destruction of the intestinal barrier [45].



REGULATION OF PFAS IN FOOD PACKAGING

PFAS are increasingly regulated nationally, regionally, and internationally. PFOS (its salts and PFOSF), PFOA (its salts and PFOA-related compounds), and PFHxS (its salts and PFHxS-related compounds) are listed in the Stockholm Convention for global restriction and elimination. Twelve US 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. In Europe, use of PFAS in food packaging is banned in Denmark.

For more details on PFAS restrictions and regulatory thresholds for consumer products and food packaging see Annex 2.

Because of the gradual regulation of long-chain PFAS, they 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 [46]. 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 [47].

OBJECTIVE AND SCOPE

This study was conducted to assess PFAS use and unintentional contamination in paper, cardboard, and plant-based food packaging and tableware from five regions (Asia, Africa, Middle East and North Africa, Eastern Europe, Latin America and the Caribbean), and to contribute to the discussion on a need for a global ban of all PFAS. It was conducted by IPEN together with the following partner organizations: AEEFG (Tunisia), CARPIN (Jamaica), CEPHED (Nepal), CZWDA (Zambia), Ecowaste Coalition (Philippines), FECC (Egypt), LPD (Benin), Green Home (Montenegro), Ayadi (Jordan), IDIS (Philippines), JVE (Cameroon), KWA) (Kuwait), AMSETox (Morocco), OUSANEG (Mexico), Taiwan Watch Institute (Taiwan), Taller Ecologista (Argentina), Together (Iraq), and Toxics Link (India).

METHODOLOGY

SAMPLE COLLECTION AND SELECTION

Participating organizations were instructed to collect at least 10 paper, cardboard, or plant-based single-use food packaging and tableware items of national and international (global fast-food chains) importance. At least 2 different items for each of the following packaging/tableware categories were requested to be collected by the survey coordinator: **I**) **fast-food paper wrappers, II**) **microwave popcorn bags, III**) **plant-based boxes for takeaway meal or disposable tableware, IV**) **cardboard packaging for greasy meal, and V**) **recycled paper packaging for non-greasy food.** If certain items were not available, participating organizations could extend the number of items from other categories or purchase other potentially grease-resistant food packaging.

In total, 233 paper, cardboard, and plant-based food packaging and single-use tableware items were purchased in food stores and fast-food restaurants from 17 countries (Tunisia, Egypt, Jordan, Kuwait, Morocco, Iraq, Montenegro, Jamaica, Mexico, Argentina, Benin, Zambia, Cameroon, Philippines, Taiwan, Nepal and India) between July and October 2022. All items were shipped to the Prague office of the Czechia-based NGO *Arnika*. The oil repellency properties of the collected items were tested at Arnika's office using the olive oil droplet test [48], also known as the "beading test". Olive oil was dripped onto the surface of the paper/cardboard or plant fiber item, and the observations of oil beading, spreading, or soaking were recorded.

Oil-beading and spreading samples were selected for lab analysis to maximize the number of oil-repellent or greasy-resistant items. Such items were presumed to be treated by PFAS or by another chemical or non-chemical alternative. To maintain geographical balance, a minimum of 3 items were selected for lab analysis per country, and therefore, some oil-soaking samples were included in the sample selection if oil-beading or -spreading items were not identified from the respective country. Moreover, some oil-soaking items made of recycled paper and not-intended for greasy food paper were included in the selection to assess unintentional

PFAS contamination. See the numbers of items selected for lab analysis in Annex 3A.

Descriptions and photographs of the lab-analyzed packaging and tableware items are given in Annex 3B and C.

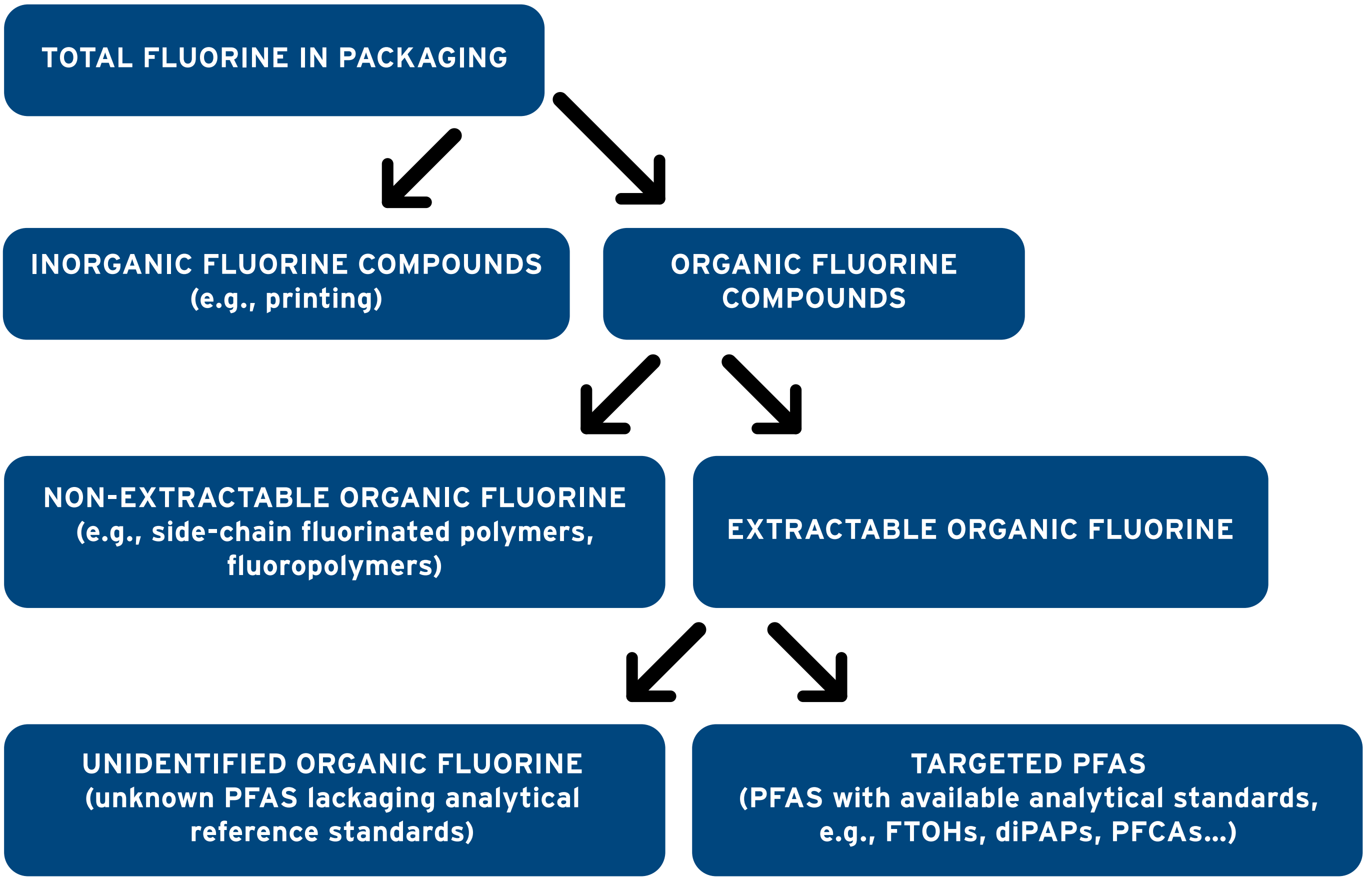
SAMPLE ANALYSIS

Samples were prepared by cutting 100 cm^2 from each packaging/tableware item. PFAS were extracted from the sample with a mixture of methanol and ethyl acetate, and the extract analyzed. The samples were prepared and analyzed at the Institute for Environmental Studies, Faculty of Science, Charles University, Czech Republic.

EOF 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 such 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 analyzed as in the case of targeted analysis.

Fifty-eight targeted PFAS (See Annex 1 for the full list of analyzed PFAS, their CAS numbers, and limits of quantification) in sample extracts were determined using high-performance liquid chromatography with tandem mass detection with electrospray ionization 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 packaging analyzed.

Diagram 1: Different forms of fluorine/PFAS in food-packaging items



FLUORINE MASS BALANCE CALCULATION

The fluorine mass balance (proportion of unidentified organic fluorine and fluorine identified by targeted PFAS analysis) was calculated according to the method described in Schultes et al. (2019) [49] with the following slight modification: the fluorine mass balance involved converting the concentrations of the specified PFAS identified in a given sample extract into their fluorine equivalent and then comparing the sum of the identified fluorine with the total extractable organic fluorine (EOF) amount measured in a given sample.
See the diagram below illustrating potential different forms of fluorine in the samples.

COMPARISON WITH LEGAL THRESHOLDS

Measured concentrations of targeted PFAS and EOF were compared with EU thresholds (see Annex 2, section on PFAS regulation in the European Union) as none of the countries involved in this study has restricted use of PFAS in food packaging or other consumer items.

SUMMARY RESULTS

Testing showed that 64 of 119 of all lab-analyzed packaging and tableware (54%) were treated with PFAS or contaminated in EOF and/or targeted PFAS analysis (See Annex 4A for full results). The items containing PFAS included fast-food packaging of global brands (including McDonald's, KFC, Burger King, Subway, Starbucks, and Dunkin's Donuts), plant-based food containers and tableware, microwave popcorn bags, and food packing made of recycled paper. The product category where PFAS was detected most frequently was microwave popcorn bags (see Table 2 for more details). Samples containing PFAS were identified across geographic regions with the Middle East and North Africa region having the highest share (see Annex 4B for summary results per geographic region).

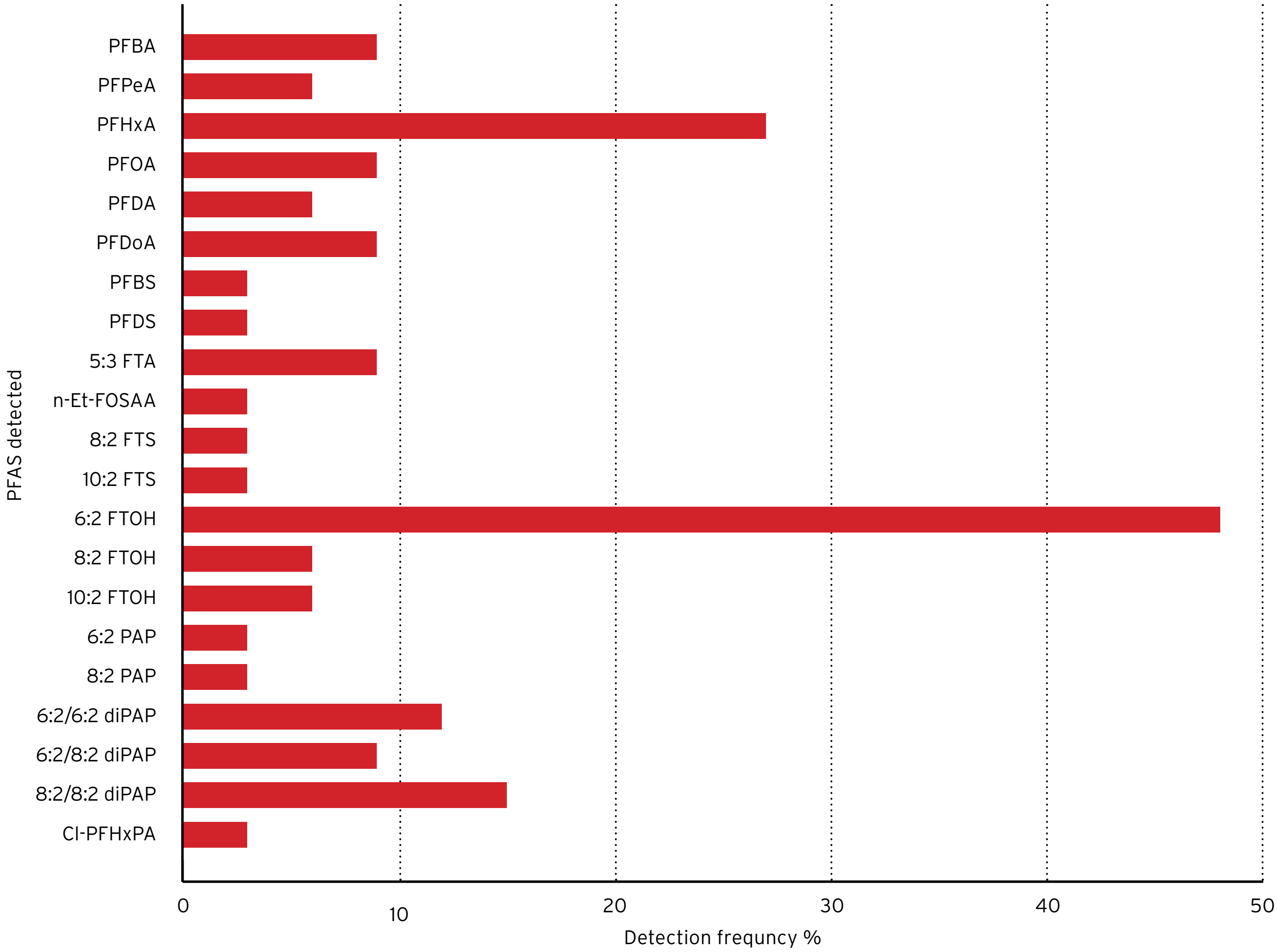
Out of the 58 targeted PFAS (See Annex 1), 21 PFAS were identified in the analyzed samples of food packaging and tableware (See Graph 1 for PFAS detection frequencies in samples). Fluorotelomer alcohol 6:2 FTOH was the most frequently identified PFAS in the analyzed samples and in the highest concentrations.

The highest concentrations of both EOF and total PFAS were consistently found in disposable plant-based (sugar cane or corn starch) molded fiber products (e.g., bowls, plates, and food boxes) advertised as biodegradable or compostable (See Table 2 for summary results per sample category and Graph 2 for comparison of EOF ranges between three paper packaging sample categories).

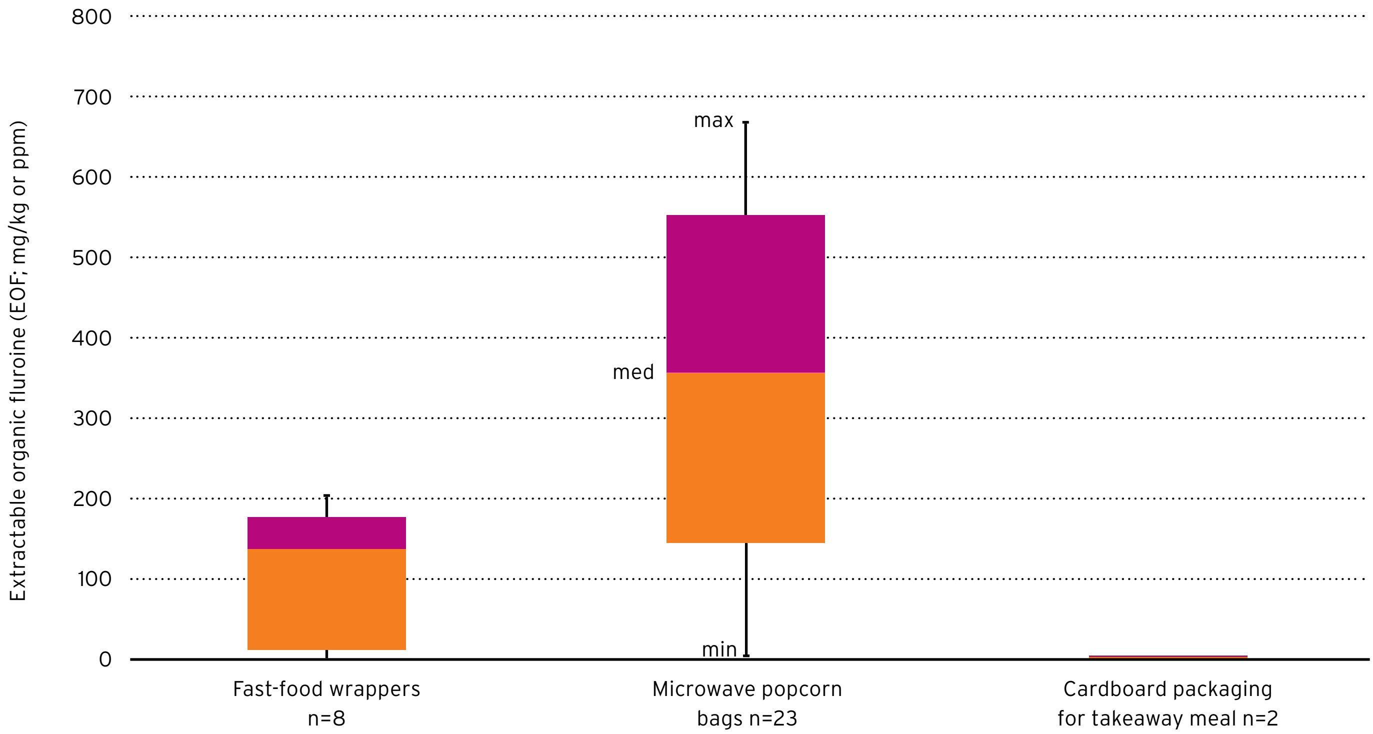
Four out of 12 samples of paper packaging for non-greasy food made of recycled paper were found to be contaminated with PFAS.

Between 0 and 2% of the organic fluorine quantified in the sample extracts (EOF) could be assigned to specific PFAS chemicals identified via targeted analysis. This means that, at minimum, 98% or of the total PFAS load remains unidentified.

Graph 1: Frequency (%) of individual PFAS in PFAS-positive samples



Graph 2: Ranges of EOF concentrations (mg/kg or ppm) for three paper packaging sample categories (calculated from EOF-positive samples)



COMPARISON OF MEASURED PFAS CONCENTRATIONS WITH EXISTING LEGAL THRESHOLDS

EXISTING THRESHOLDS USED FOR COMPARISON

- 25 ppb for PFOA by the EU POPs Regulation
- 25 ppb for any PFAS measured in targeted PFAS analysis by the EU REACH restriction proposal
- 250 ppb for the sum of targeted PFAS by the EU REACH proposal (contrary to REACH proposal suggesting utilization of Total Oxidizable Precursors (TOP assay), our method using HPLC-ESI-MS/MS on sample extracts underestimated the PFAS concentrations in samples, because it measured targeted PFAS without prior degradation of precursors)
- 50 ppm for TOF by the EU REACH proposal (contrary to REACH proposal suggesting utilization of Total Organic Fluorine (TOF) analysis, our method using CIC on sample extracts (measuring so called extractable organic fluorine EOF) excluded organic fluorine from fluoropolymers and, to a certain extent, also from side-chain fluorinated polymers)
- 20 ppm for TOF by the Danish Veterinary and Food Administration, where higher concentrations indicate intentional use of PFAS in paper and cardboard food packaging (contrary to Danish legislation setting TOF as the reference method, our EOF method underestimated the concentration of organic fluorine as it was measured on sample extracts)

Four samples contained PFAS at levels above EU limits for PFOA and/or for long-chain PFCAs.

Fifty-three samples contained PFAS or EOF levels above at least one of the proposed limits under the EU REACH universal ban.

Using the Danish indicator value, intentional PFAS treatment was indicated in 39 out of the 119 samples (33%).

See Table 2 for comparison of identified PFAS concentrations with the existing legal thresholds in each sample category. For summary results and comparison with the existing legal thresholds per region see Annex 4B.

Table 2: Summary results and comparisons with legislative thresholds per sample category

Criterion	Legal threshold	Fast-food paper wrappers (35 samples)	Microwave popcorn bags (28 samples)	Plant-based boxes for takeaway meals or disposable tableware (8 samples)	Cardboard packaging for greasy meals (19 samples)	Recycled paper packaging for non-greasy food (12 samples)
Number (and percentage) of PFAS positive sample	EOF > 0 or individual targeted PFAS > 0	15 (43%)	24 (86%)	6 (75%)	5 (26%)	6 (50%)
***Median/maximum EOF concentrations (ppm)**	-	139/204	358/670	6 619/27 551	160/162	56/82
***Median/maximum total concentration of targeted PFAS (ppb)**	-	181/777	756/7 182	4 829/61 206	620/1 847	203/826
Number (and percentage) of samples with intentional PFAS treatment**	Danish indicator value for intentional treatment of food packaging set at TOF>20ppm	5/8 (63%)	21/23 (91%)	4/4 (100%)	2/2 (100%)	2/2 (100%)
Number of samples with PFOA concentration over 25 ppb	Threshold of 25 ppb set in the EU POPs Directive	0	2	1	0	0
Number of samples with total the concentration of long-chain PFCAs over 25 ppb	Threshold of 25 ppb for the sum of ion-chain PFAS set by EU REACH	0	2	1	0	0
Number of samples with at least one exceeded threshold value	EU REACH proposal for universal ban of PFAS I) 50 ppm for TOF/EOF, II) 25 ppb for any individual PFAS, or III) 250 ppb for the sum of individual PFAS	10	20	6	5	6
Most frequent PFAS per sample category	-	PFHxA	6:2 FTOH	6:2 FTOH	6:2 FTOH	6:2/6:2 diPAP
PFAS with the highest concentration in the sample category	-	6:2 FTOH	8:2 FTOH	6:2 FTOH	6:2 FTOH	6:2 FTOH

** median (middle concentration) and maximum concentrations were calculated based on samples above the Limit of Quantification LOQ)*
*** number of samples with intentional PFAS treatment expressed as EOF concentration over 20 ppm from the total number of EOF-positive samples*

DISCUSSION

DISPOSABLE TAKEAWAY PACKAGING AND TABLEWARE - SOURCE OF PFAS EXPOSURE

Direct exposure

This study showed the presence of 21 identified PFAS in food packaging, including fluorotelomer alcohols (FTOHs), polyfluorinated alkyl phosphate esters (PAPs), and perflurocarboxylic acids (PFCAs). These have also been shown in our earlier study to be typical representatives of PFAS identified in food packaging [30]. PAPs can be metabolized into FTOHs and further into PFCAs. These PFAS are associated with hepatotoxicity, development of mammary gland cancer, negative impacts on the reproductive system, and developmental disorders [50-55]. Similar food packaging samples as those analyzed in this study have previously been shown to exhibit thyroid disruption effects [30].

The PFAS identified in the samples have also been reported to migrate from food contact materials into the food [39, 41, 42, 56]. Specifically, microwave popcorn consumption is associated "...with significantly higher serum levels of PFOA, PFNA, PFDA, and PFOS..." and "an increase in PFDA was seen among those who ate popcorn daily over the last 12 months" [57]. People who regularly ate microwave popcorn tended to have significantly higher PFAS levels in their blood [58, 59].

Moreover, a large amount of unidentified PFAS was present in the samples as indicated by the results from the mass balance calculations (share of extractable organic fluorine and targeted PFAS), with unknown health and environmental hazards.

Therefore, consumers are exposed to PFAS that migrate from the packaging to the food and the exposure increases with more frequent consumption. The popularity of fast-food among young people raises concerns regarding the contribution of food packaging to PFAS exposures during crucial times of development. This also adds to the existing dietary exposures caused by consumption of food and water that is contaminated with PFAS and other persistent pollutants [32, 36, 57, 60, 61].

Indirect exposure

Disposable takeaway packaging are single-use items meant to be thrown away once the food was consumed. Single-use packaging is produced and disposed of in large amounts to meet fast-food and takeaway market demands. Thus, the extensively produced and discarded packaging materials contribute to indirect exposure related to environmental contamination with PFAS both during the manufacture of the products and after their disposal [13, 16, 62, 63].

Facilities manufacturing PFAS-treated paper emit PFAS into the air and wastewater and pollute the surrounding environment [13, 62, 63]. Disposal of PFAS-treated food contact materials in municipal incinerators leads to emissions of PFAS, fluorinated greenhouse gases and other products of incomplete combustion into the surrounding environment [16, 64-66]. Some PFAS remain in the after-incineration fly ash [66-68], and then contribute to further environmental exposure when the fly ash is landfilled or used as construction material [69].

Moreover, plant-based molded fiber packaging and tableware sold as compostable could lead to PFAS-contaminated compost, leading to an accumulation of PFAS in crops grown in soil treated with that compost. Compost that includes single-use packaging and tableware may be hazardous due to high concentrations of PFAS [70-72].

CONTRIBUTION OF SIDE-CHAIN FLUORINATED POLYMERS TO UNIDENTIFIED PFAS

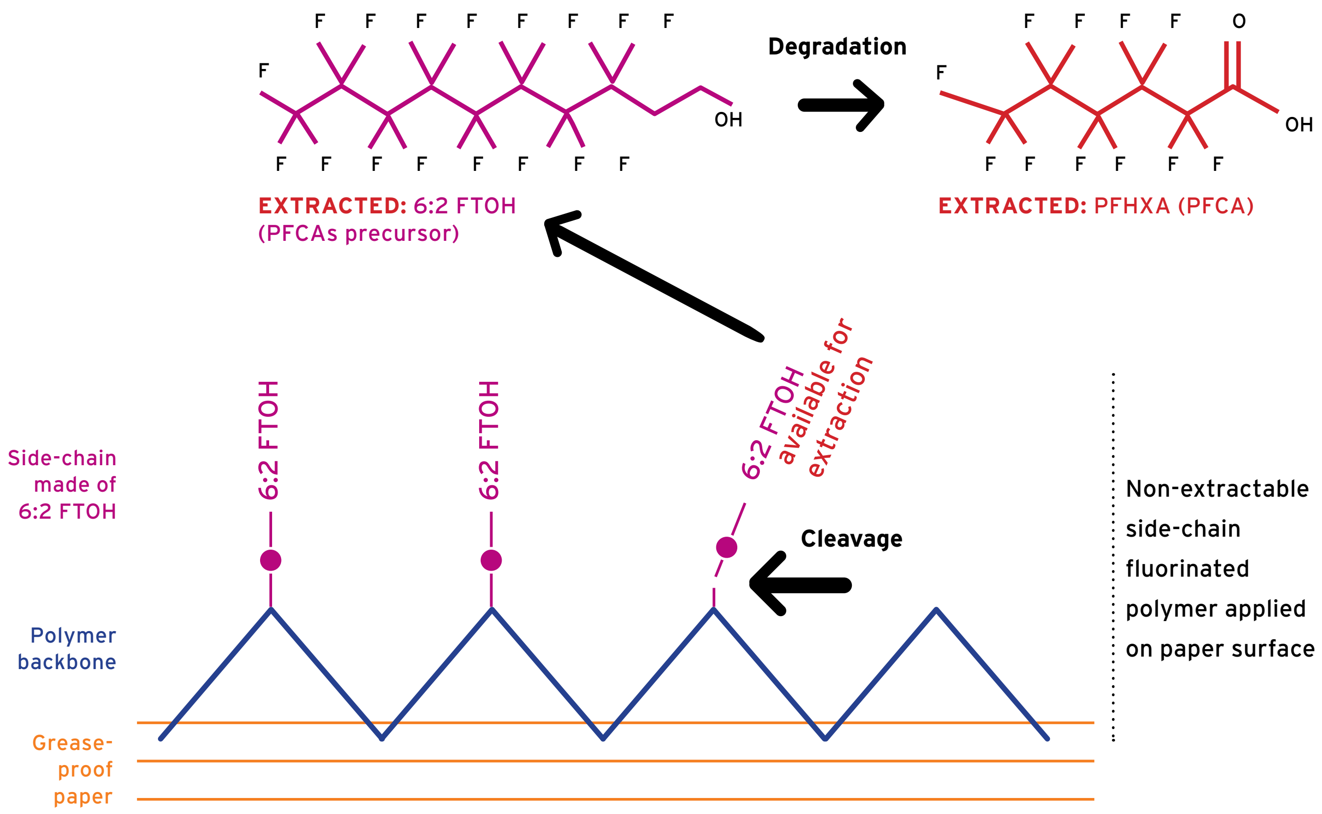
Based on the mass balance calculations, only a maximum of 2% of the extractable organic fluorine present in our samples could be identified by targeted, compound-specific analysis of 58 PFAS. The limited amount of identifiable PFAS in food packaging highlights both the current limitations of targeted PFAS analysis and the lack of commercially available standards to allow identification and quantification of all relevant PFAS used for treating food packaging [73-75]. **That means that it is not only challenging to identify the other PFAS present, but also to control them. Despite not being identified individually, concerns exist around the whole class of PFAS due to their ability to persist and accumulate in the environment.**

The gap between the extractable organic fluorine (EOF) data and the sum of fluorine from the targeted PFAS analyzed can be explained by the treatment of food packaging with side-chain fluorinated polymers (SFPs) [76-78]. SFPs are polymeric PFAS and are not extractable, which means that they are not covered by the method used in this study. However, they are known to degrade and release non-polymeric PFAS that are extractable. For example, 6:2 FTOH side-chains from SFPs degrade into PFHxA [14, 76, 79] See Diagram 2). Therefore, the method used in this study can detect them indirectly and the results can be used to infer the use of side-chain fluorotelomer-based polymers. In other words, **the presence of fluorotelomer alcohols (FTOHs) and perfluorocarboxylic acids (PFCAs) in samples investigated in this study can result in the degradation of fluorotelomer-based side-chain polymers.**

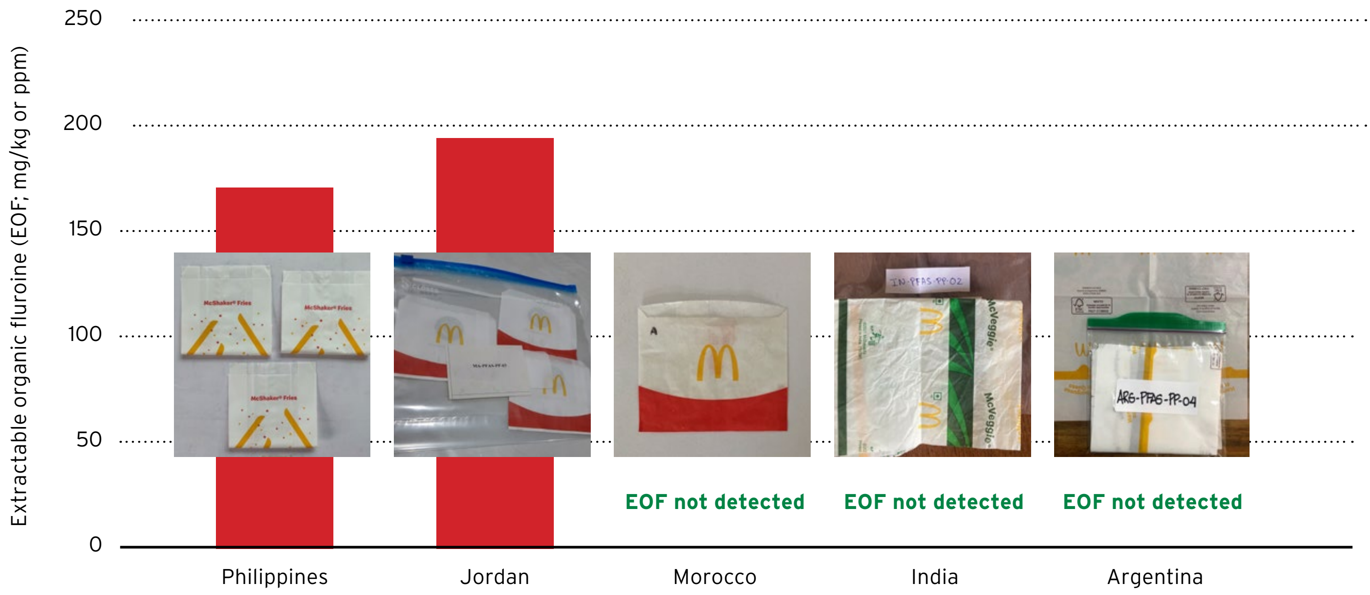
INCONSISTENCIES BY MAJOR FAST-FOOD CHAINS

This study shows that food packaging and tableware for fatty/oily meals can be produced without PFAS treatment. Every sample category in this study contained both PFAS-treated and PFAS-free products, showing that PFAS-free alternatives exist and are in use. Because alternatives to PFAS treatments already exist, and even more importantly, because safe, durable, and reusable packaging and tableware are widely available, the treatment of disposable items with PFAS is a typical example of unnecessary and avoidable PFAS uses.

Diagram 2: Extractable 6:2 FTOH as an indication of non-extractable side-chain fluorinated polymers (SFPs) presence in food packaging samples



Graph 3: PFAS-treated and PFAS-free fast-food wrapping by McDonald's: An example of inconsistency in PFAS use across countries



Consistent with our previous study on food packaging and tableware in Europe [30], our current findings highlight inconsistent use of PFAS-treated and PFAS-free packaging by leading fast-food chains including McDonald's, KFC, Burger King, Subway, Dunkin's Donuts, and Starbucks. For example, our earlier analysis of a McDonald's hamburger wrapper from Denmark, where PFAS are restricted in food packaging, showed background contamination, but no intentional PFAS treatment based on the organic fluorine level measurements [30]. However, the analysis of the same wrapper from Germany and the Czech Republic, where no PFAS legislation on food packaging was in force, proved intentional PFAS treatment. Despite complying with PFAS restriction in food packaging in Denmark, McDonald's committed to abandon the use of PFAS in its packaging no earlier than 2025. Similarly, the data in this study enables comparison of McDonald's wrappers from several countries. PFAS or EOF was not detected in wrappers from India, Morrocco, or Argentina, but the wrappers from Philippines and Jordan are intentionally treated based on elevated levels of extractable organic fluorine (EOF) (see Graph 3). This example shows inconsistency in McDonald's PFAS policy - it is able to find alternatives but does not use them in all places of its operation.

CONTAMINATED RECYCLED PAPER

The PFAS contamination identified in recycled paper items investigated in this study are most likely to come from PFAS-treated source materials [80-82]. Recycling of PFAS-treated paper leads to further contamination of new products. The PFAS-contaminated source paper poses a barrier to the recyclability of paper and cardboard food packaging in the framework of a clean and safe circular economy[83].

CONCLUSIONS

The findings of our study point to the ongoing use of PFAS in disposable food packaging and tableware across continents. These items are meant to be used for a very short time and then thrown away. This contrasts with the extreme persistence of all PFAS chemicals. On the other hand, the study confirms the existence of viable alternatives in all sample categories. The study also highlights different practices and inconsistencies by major fast-food chains, which use PFAS-treated wrappers in some countries and PFAS-free versions of the same packaging in other countries. These findings demonstrate that companies are ready to phase out PFAS in fast-food packaging and tableware, but policy incentives and public pressure are needed to accelerate the change.

In addition, our results suggest that recycling PFAS-treated paper leads to uncontrolled exposure without any possibility of tracing their presence in recycled consumer products manufactured from contaminated materials. Therefore, the use of PFAS creates a barrier to a circular economy and decreases the credibility of recycling.

Considering the health and environmental concerns of 'Forever Chemicals', the fact that PFAS in food packaging are not essential, alternatives already exist, and companies are ready to phase out PFAS. They should be banned and non-PFAS safer alternatives should be used instead. Only a global ban of the entire class of PFAS and the application of analytic methods enabling screening of the entire PFAS class (e.g., total organic fluorine) is an effective measure to reduce human exposure and releases of highly persistent PFAS into the environment.

RECOMMENDATIONS

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

ALL NATIONAL GOVERNMENTS:

1. To immediately ban all PFAS uses in food contact materials and other consumer products.
2. To support the development of a universal (covering all PFAS, including fluorinated polymers and side-chain fluorinated polymers) ban on PFAS and thereafter, fully implement it. Application of analytic methods enabling screening of the entire PFAS class (e.g., total organic fluorine) is already in force in some countries (e.g. Denmark).
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.

PARTIES TO THE STOCKHOLM CONVENTION:

1. To ratify the amendments listing PFOS, PFOA, and PFHxS and support ending 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 towards 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 to ensure no PFAS contaminated hazardous waste are exported or imported 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 noncircular, in the Technical guidelines on the identification and environmentally sound management (ESM) of plastic wastes and for their disposal.
4. To work towards a class-based approach when determining maximum limits for PFAS content in waste (the so-called "low POPs content" levels) and to set the level for the sum of PFAS at 10 mg/g (ppm).

STAKEHOLDERS OF THE GLOBAL FRAMEWORK ON CHEMICALS – FOR A PLANET FREE OF HARM FROM CHEMICALS AND WASTE:

1. To significantly increase efforts towards transitioning to safe, non-PFAS alternatives, including establshing 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 on 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.

FAST-FOOD CHAINS AND FOOD RETAILERS:

1. To adopt and implement a public policy with clear quantifiable goals and timelines for reducing and eliminating PFAS in all food contact materials in their shops or restaurants and supply chains.
2. To display their commitment towards moving away from hazardous chemicals.
3. To ensure PFAS substitutes are safer.
4. To provide safe, reusable food serviceware for in-store dining and train staff to make this the default for customers dining in.
5. To publicly report on progress and announce when their food contact materials are PFAS-free.

CITIZENS:

1. To avoid using disposable food packaging whenever possible. Bringing their own reusable food containers when visiting fast-food chains and takeaway restaurants to avoid paper, cardboard, and molded fiber food packaging potentially treated with PFAS.
2. To NOT dispose of molded plant fiber compostables into the compost waste bins or their own home compost, as they are often heavily treated with PFAS.

ANNEX 1: CHEMICAL NAMES, CAS NUMBERS, AND LIMITS OF QUANTIFICATION (LOQS) OF 58 PFAS ANALYZED IN THIS STUDY

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
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

PFAS	Name	CAS	Limit of quantification of LC-MS analysis (ng/ml extract)	Limit of quantification of entire method (ng/100cm² fabric)
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: PFAS RESTRICTIONS AND CONCENTRATION THRESHOLDS IN CONSUMER PRODUCTS AND FOOD PACKAGING

PFAS REGULATION BY THE STOCKHOLM CONVENTION

PFOS (its salts and PFOSF), PFOA (its salts and PFOA-related compounds), and PFHxS (its salts and PFHxS-related compounds) are listed in the Stockholm Convention for global restriction and elimination. The PFOS listing in force since 2010 for most countries was amended in 2020. The PFOA listing entered into force for most countries in 2020. 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) was recommended to the next Conference of Parties to the Stockholm Convention in 2025.

PFAS REGULATION IN THE EUROPEAN UNION

The EU POPs Regulation 2019/1021, which transposes the Stockholm Convention restrictions into European legislation, sets maximum concentrations 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 or ppm
- 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 the 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). Manufacturers, suppliers, and retailers must 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 far too high to be protective 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 a constituent 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 on the EU market (a few minor exemptions are proposed for protective professional textile equipment). The proposal also identifies the entire textile sector (including textiles, upholstery, leather, apparel and carpets) as the second largest contributor to PFAS emissions.

The restriction proposal by ECHA contains the following 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)
3. 50 ppm for PFAS, including polymeric PFAS (measured as total organic fluorine).

In addition, since July 2020, Denmark has prohibited PFAS in food contact paper and cardboard. The ban covers both direct uses (addition of PFAS to make the material water and grease resistant) and indirect uses (addition originating from inks or the use of recycled paper). The Danish guided indicator value of 20 ppm dry weight total organic fluorine (TOF) was established as a means of differentiating between intentionally added PFAS and background levels of PFAS in paper/cardboard food contact materials.

ANNEX 3A: NUMBER OF ITEMS COLLECTED AND SELECTED FOR LAB ANALYSIS PER COUNTRY

Region	Country	Total number of samples collected	Samples selected for lab analysis					
			Fast-food paper wrappers	Microwave popcorn bags	Plant-based boxes for takeaway meal or disposable tableware	Cardboard packaging for greasy meal	Recycled paper packaging for non-greasy food	Other
Middle East and North Africa	Tunisia	9		1		2		3
	Egypt	14		10		1		
	Jordan	15	3	2	1		1	
	Kuwait	9	3	2	1			
	Morocco	15	4				1	1
	Iraq	16	2	2		1	3	
Eastern Europe	Montenegro	9	1	2			2	
Latin America and the Caribbean	Jamaica	9	1	1		2		1
	Mexico	26	3	1		3	4	1
	Argentina	6	3					
Africa	Benin	17	1			2		1
	Zambia	4	1			1		2
	Cameroon	24	2					3
South, East, and South-East Asia	Philippines	21	4	2	4	1		1
	Taiwan	17	2	2	1		2	1
	Nepal	22	1	1	1	4		2
	India	12	4	2		1		

ANNEX 3B: DESCRIPTION OF LAB-ANALYZED PACKAGING AND TABLEWARE ITEMS

REGIONS

SA/EA/SEA...South, East, and South-East Asia
Africa..............Anglophone and Francophone Africa
MENA..............Middle East and North Africa
EE....................Eastern Europe
LAC..................Latin America and Carribean

FAST FOOD CHAINS/COMPANIES

- Burger King
- KFC
- Subway
- McDonald's
- ACT II
- Burger Singh
- JOLLY TIME
- DUNKIN' DONUTS
- STARBUCKS

#Photo	Sample ID	Country	Region	Sample type	Sample category	Product packed	Fast food chain	Labelling
1	ZM-PFAS-PP-01	Zambia	Africa	Paper wrapper	Fastfood paper wrapper	French fries	Hungry Lion	Made of Recycled paper
2	ZM-PFAS-PP-02	Zambia	Africa	Cupcake	Baking paper/cup	Muffin	Shoprite East Park Mall	Made of Recycled Paper
3	ZM-PFAS-CB-03	Zambia	Africa	Cardboard pizza box	Takeaway cardboard box	Pizza	Debonairs Pizza	Made of Recycled card box
4	ZM-PFAS-MFP-04	Zambia	Africa	Paper plate	Paper tableware	Takeaway meal	Twinsaver paper plates	Recycled moulded paper
5	TN-PFAS-PP-02	Tunisia	MENA	Baking paper	Baking paper/cup	Pastry	Pastry shop	-
6	TN-PFAS-PP-05	Tunisia	MENA	Cardboard box for fries	Takeaway cardboard box	French fries	O'potatos	-
7	TN-PFAS-PP-06	Tunisia	MENA	Cardboard box	Takeaway cardboard box	Chicken Snacker	KFC	Recycling box
8	TN-PFAS-PP-07	Tunisia	MENA	Coffee cup	Paper cup	Coffee, tea	Coffee shop	Recycling cup
9	TN-PFAS-PP-08	Tunisia	MENA	Cupcake	Baking paper/cup	Pastry	Pastry shop	-
10	TN-PFAS-PP-09	Tunisia	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	Céréalis	c-4436D
11	TW-PFAS-PP-03	Taiwan	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	Red bean pie	Mos Burger	-
12	TW-PFAS-PP-04	Taiwan	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	French fries	T.K.K Fried Chicken	-
13	TW-PFAS-PP-05	Taiwan	SA/EA/SEA	Paper wrapper	Bakery	Cookie	Subway	-
14	TW-PFAS-MFP-03	Taiwan	SA/EA/SEA	Box for takeaway meal	Plant-based	Takeaway meal	Local restaurant	-
15	TW-PFAS-MPB-01	Taiwan	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	Jolly Time, 7-11	-
16	TW-PFAS-MPB-02	Taiwan	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	Kirkland Signature, Costco	-
17	TW-PFAS-RPP-01	Taiwan	SA/EA/SEA	Egg packaging	Recycled paper	Eggs	Homemakers Union Consumers Co-op	
18	TW-PFAS-RPP-02	Taiwan	SA/EA/SEA	Egg packaging	Recycled paper	Eggs	PX Mart	
19	PH-PFAS-PP-07	Philippines	SA/EA/SEA	Cardboard pizza box	Takeaway cardboard box	Pizza	Greenwich, Toril, Davao City	-
20	PH-PFAS-MFP-08	Philippines	SA/EA/SEA	Box for takeaway meal	Plant-based	Takeaway meal	SM City, Ecoland, Davao City	Made from constarch; Recyclable

#Photo	Sample ID	Country	Region	Sample type	Sample category	Product packed	Fast food chain	Labelling
21	PH-PFAS-MFP-09	Philippines	SA/EA/SEA	Box for takeaway meal	Plant-based	Takeaway meal	SM City, Ecoland, Davao City	Cornstarch Lunch Box; Recyclable
22	PH-PFAS-PP-11	Philippines	SA/EA/SEA	Box for takeaway meal	Plant-based	Ham and Cheese Crepe	Starbucks, Jazz Mall, Makati City	The compostable container is not labeled; the plastic lid bears recycling symbol #1 (PET)
23	PH-PFAS-PP-12	Philippines	SA/EA/SEA	Box for takeaway meal	Plant-based	Takeaway meal	"Eco Innovators Meal Tray - SM Hypermarket, Jazz Mall, Makati City"	Made from sugarcane starch
24	PH-PFAS-PP-13	Philippines	SA/EA/SEA	Paper wrapper	Bakery	Cookie	Starbucks, Jazz Mall, Makati City	Made with 100% unbleached paper
25	PH-PFAS-PP-14	Philippines	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	French Fries	Burger King, Matalino St., Quezon City	-
26	PH-PFAS-PP-15	Philippines	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	McShaker Fries	McDonald's, Matalino St., Quezon City	Mix. Packaging from responsible sources
27	PH-PFAS-PP-16	Philippines	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter licious	Jolly Time, Shopwise, Cubao, Quezon City	-
28	PH-PFAS-PP-17	Philippines	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter Overload	Popperoo, 7-Eleven, EAC, Manila City	-
29	PH-PFAS-PP-18	Philippines	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	Donuts	Dunkin' Donuts, Manila	Biodegradable
30	PH-PFAS-PP-19E	Philippines	SA/EA/SEA	Paper wrapper	"Bakery Fastfood paper wrapper"	Takeaway meal	Armada lunch bags Araneta Center, Cubao, Quezon City	Made from recycled material
31	NP-PFAS-PP-01	Nepal	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	American Garden, Bhatbhateni Super Market	Made of recycled paper
32	NP-PFAS-PP-02	Nepal	SA/EA/SEA	Cardboard box	Takeaway cardboard box	Fastfood	KFC	Disposable
33	NP-PFAS-PP-04	Nepal	SA/EA/SEA	Cardboard box	Takeaway cardboard box	Donuts	Swastik Sweets and Snacks Pvt Ltd	Disposable
34	NP-PFAS-PP-05	Nepal	SA/EA/SEA	Coffee cup	Paper cup	Coffee, tea	Bishnu Store	Disposable
35	NP-PFAS-PP-06	Nepal	SA/EA/SEA	Cardboard box	Takeaway cardboard box	Burger	KFC	Disposable
36	NP-PFAS-PP-07	Nepal	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	French fries	KFC	Recycabale
37	NP-PFAS-PP-08	Nepal	SA/EA/SEA	Cardboard box	Takeaway cardboard box	French fries	KFC	Made of recycled paper
38	NP-PFAS-PP-09	Nepal	SA/EA/SEA	Coffee cup	Paper cup	Coffee	Bishnu Store	Recycabale
39	NP-PFAS-PP-10	Nepal	SA/EA/SEA	Moulded Fibre Plate	Plant-based	Takeaway meal	Bhatbhateni Super Market	Compostable and Biodegradable
40	MA-PFAS-PP-03	Marocco	MENA	Paper wrapper for fried food	Fastfood paper wrapper	French fries	McDonald's International fast-food chain brand	-
41	MA-PFAS-PP-04	Marocco	MENA	Paper wrapper for fried food	Fastfood paper wrapper	French fries	Burger King	-
42	MA-PFAS-PP-05	Marocco	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Chicken burger	Burger King	-
43	MA-PFAS-PP-09	Marocco	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Donuts	Dunkin' Donuts	-
44	MA-PFAS-PP-13	Marocco	MENA	Paper wrapper	Bakery	Cookie	Starbucks	Made with 100% Recycled fiber
45	MA-PFAS-PP-14	Marocco	MENA	Napkins	Recycled paper		Dunkin' Donuts	Made from Recycled fiber

#Photo	Sample ID	Country	Region	Sample type	Sample category	Product packed	Fast food chain	Labelling
46	JO-PFAS-PP-01A	Jordan	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Happy meal - Fries bags	McDonald's	FSC- paper from responsible resources
47	JO-PFAS-PP-01B	Jordan	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Happy meal - Chicken Burger wrapper	McDonald's	FSC- paper from responsible resources
48	JO-PFAS-PP-02	Jordan	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Twister Sandwish	KFC	FSC
49	JO-PFAS-MFT-01	Jordan	MENA	Box	Plant-based	Takeaway meal	RZ-AL Hadaf INTL CO. for importing & industry L.L.c	ECO friendly, Biodegradable food container with lid
50	JO-PFAS-RPP-01	Jordan	MENA	Paper box	"Recycled paper Other"	Freekeh (a cereal food made from green durum wheat that is roasted and mashed to create its flavour.)	El Basha	Recycled material
51	JO-PFAS-MPB-01	Jordan	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour	KSIH	
52	JO-PFAS-MPB-02	Jordan	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Extra Butter	American Garden	-
53	MNE-PFAS-PP-03	Podgorica	EE	Paper wrapper for fried food	Fastfood paper wrapper	Gyros/French fries	Home of gyros	-
54	MNE-PFAS-MPB-01	Podgorica	EE	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	Berny	-
55	MNE-PFAS-MPB-02	Podgorica	EE	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	Mogyi	-
56	MNE-PFAS-RPP-01	Podgorica	EE	Egg packaging	Recycled paper	Eggs	Kovacevic	-
57	MNE-PFAS-RPP-02	Podgorica	EE	Egg packaging	Recycled paper	Eggs	Farma Martinici	-
58	EG-PFAS-CB-01	Egypt	MENA	Cardboard box	Takeaway cardboard box	Grand Chicken	McDonald's	FSC- packaging from respisible sources
59	EG-PFAS-MPB-01	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour	Freshly	-
60	EG-PFAS-MPB-02A	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Honey	Top of the POP	-
61	EG-PFAS-MPB-02B	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Salt	Top of the POP	-
62	EG-PFAS-MPB-02C	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Salted caramel	Top of the POP	-
63	EG-PFAS-MPB-02D	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Hot pepper	Top of the POP	-
64	EG-PFAS-MPB-02E	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Choco a caramel	Top of the POP	-
65	EG-PFAS-MPB-03A	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour	POPZ	-
66	EG-PFAS-MPB-03B	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Sweet a salty	POPZ	-
67	EG-PFAS-MPB-04A	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Sweet	POPCorn	-
68	EG-PFAS-MPB-04B	Egypt	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour, Cheese	POPCorn	-
69	IQ-PFAS-PP-03	Iraq	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Shawrma chicken	Mishaltet House	-
70	IQ-PFAS-PP-04	Iraq	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Roll up burger	KFC	-
71	IQ-PFAS-CB-05	Iraq	MENA	Cardboard box	Takeaway cardboard box	French fries	Burger King	FSC MIX packaging from responsible sources

#Photo	Sample ID	Country	Region	Sample type	Sample category	Product packed	Fast food chain	Labelling
72	IQ-PFAS-RPP-03A	Iraq	MENA	Paper box	Recycled paper	Cereals (Special)	Activity	Recycled Paper
73	IQ-PFAS-RPP-03B	Iraq	MENA	Paper box	Recycled paper	Cereals (Chocoshell)	Activity	Recycled Paper
74	IQ-PFAS-RPP-03C	Iraq	MENA	Paper box	Recycled paper	Cereals (Choco Cereals)	Activity	Recycled Paper
75	IQ-PFAS-MPB-01	Iraq	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Butter flavour	KASIH	-
76	IQ-PFAS-MPB-02	Iraq	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Lite Butter	American Garden	-
77	CMR-PFAS-PP-01	Cameroon	Africa	Paper wrapper	Fastfood paper wrapper	Hamburger	Acropole	-
78	CMR-PFAS-RPP-06	Cameroon	Africa	Tray	Paper tableware	Takeaway meal	-	-
79	CMR-PFAS-RPP-03	Cameroon	Africa	Tray	Paper tableware	Takeaway meal	-	-
80	CMR-PFAS-PP-07	Cameroon	Africa	Paper wrapper	Fastfood paper wrapper	Hamburger	Idole Sarl	-
81	CMR-PFAS-RPP-04	Cameroon	Africa	Paper wrapper	Paper packaging	Sucre blond	Princesse Tatie, Sosucam	-
82	KW-PFAS-PP-02	Kuwait	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Meat kebab sandwich/ meat shawarma sandwich/ chicken shawarma sandwich	Shawarma Sharaf	-
83	KW-PFAS-PP-04	Kuwait	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Wild zaatar multicereal/zaatar oat dough/ smoked beef &cheese oatdough/kashkawan oat dough	Zaatar&Zeit	-
84	KW-PFAS-PP-05	Kuwait	MENA	Paper wrapper for fried food	Fastfood paper wrapper	Wagyu burger box/ row meat	The butchery	-
85	KW-PFAS-MFT-01	Kuwait	MENA	Bowls	Plant-based	Wagyu burger box/ frech tomatoes, lettuce,onions, cheddar	The butchery	Compostable(115)/eg-0.8/registred deseign compostable en13432 / compostable tray *10 / compostable tray *21
86	KW-PFAS-MPB-01	Kuwait	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - Natural flavor	Jolly Time	GENB4-2111
87	KW-PFAS-MPB-02	Kuwait	MENA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn - simply salted	Orville Rendenbacher's	PRS3
88	BN-PFAS-CB-01	Benin	Africa	Cardboard box	Takeaway cardboard box	Cake	Imprim'vert	cardboard recyclable, FSC C104473/www.fsc.org
89	BN-PFAS-PP-01	Benin	Africa	Cardboard box	Takeaway cardboard box	French fries	Hot Fries	-
90	BN-PFAS-MFP-01	Benin	Africa	Paper wrapper	Fastfood paper wrapper	Shawama	Shawama bag	-
91	BN-PFAS-CB-07	Benin	Africa	Coffee cup	Paper cup	Cofee	Cappuccino	-
92	BN-PFAS-CB-08	Benin	Africa	Cardboard box	Takeaway cardboard box	oasted peanuts	Imprim'vert	FSC C104473/ www.fsc.org
93	IN-PFAS-PP-01A	India	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	Burger	Burger Singh	-
94	IN-PFAS-PP-01B	India	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	Burger	Burger Singh	-
95	IN-PFAS-PP-02	India	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	Burger	McDonald's	-

#Photo	Sample ID	Country	Region	Sample type	Sample category	Product packed	Fast food chain	Labelling
96	IN-PFAS-PP-03	India	SA/EA/SEA	Paper wrapper for fried food	Fastfood paper wrapper	Burger	Burgerama	-
97	IN-PFAS-MFP-04	India	SA/EA/SEA	Cardboard box	Takeaway cardboard box	Rice biryani	KFC	-
98	IN-PFAS-MPB-08	India	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	4700 BC Popcorn	-
99	IN-PFAS-MPB-09	India	SA/EA/SEA	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	Act II	-
100	OUSANEG-PFAS-CB-01	Mexico	LAC	Cardboard box	Takeaway cardboard box	French fries	Burger King	-
101	OUSANEG-PFAS-CB-02	Mexico	LAC	Cardboard box	Takeaway cardboard box	Apple pie	McDonald's	-
102	OUSANEG-PFAS-PP-05	Mexico	LAC	Paper wrapper for fried food	Fastfood paper wrapper	Sandwich	Subway	-
103	OUSANEG-PFAS-MPB-6	Mexico	LAC	Popcorn paper bag	Microwave popcorn paper bag	Popcorn	ACT II	-
104	OUSANEG-PFAS-RPP-8	Mexico	LAC	Paper box	Recycled paper	Cereal	Kelloggs	Recycled paper packaging
105	OUSANEG-PFAS-RPP-9	Mexico	LAC	Tea pot	Recycled paper	Tea	Great Value	Recycled paper packaging
106	OUSANEG-PFAS-RPP-10	Mexico	LAC	Tea pot	Recycled paper	Tea	McCormick	Recycled paper packaging
107	OUSANEG-PFAS-PP-13	Mexico	LAC	Paper wrapper	Bakery	Coffee	Blasón-grupo Herdez	-
108	OUSANEG-PFAS-PP-18	Mexico	LAC	Paper wrapper for fried food	Fastfood paper wrapper	French fries	KFC	-
109	OUSANEG-PFAS-CB-20	Mexico	LAC	Cardboard box	Takeaway cardboard box	Hamburger	Carl's Jr	-
110	OUSANEG-PFAS-RPP-23	Mexico	LAC	Potato can	Other	Chips	Pringles-Kellogg's	Recycled paper packaging
111	OUSANEG-PFAS-RPP-24	Mexico	LAC	Paper wrapper for fried food	Fastfood paper wrapper	Nuggets	Burger King	Recycled paper packaging
112	JM-PFAS-PP-01	Jamaica	LAC	Sandwich paper wrap	Fastfood paper wrapper	Sandwiches e.g., Chicken, fish, and beef	Burger King	-
113	JM-PFAS-PP-03	Jamaica	LAC	Cup for drinks	Paper cup	Drinks	Burger King	-
114	JM-PFAS-PP-05	Jamaica	LAC	Cardboard box	Takeaway cardboard box	Rice and chicken with vegetables	Island Grill	-
115	JM-PFAS-PP-06	Jamaica	LAC	Cardboard box	Takeaway cardboard box	Chicken with biscuits	KFC	-
116	JM-PFAS-PP-08	Jamaica	LAC	Popcorn microwavable bag	Microwave popcorn paper bag	Popcorn	ACT II	Give directions to cook. Give nutritional information. Give caution warning on steam and oil.
117	ARG-PFAS-PP-01	Argentina	LAC	Paper wrapper for fried food	Fastfood paper wrapper	Ruster BBQ	KFC Degasa S.A./ Av. Cabildo 2224 C.A.B.A.	-
118	ARG-PFAS-PP-04	Argentina	LAC	Paper wrapper for fried food	Fastfood paper wrapper	Cheeseburger	Mc Donalds - Arcos Dorados Argentina Sociedad Anónima Vera Mújica 732 Rosario, Santa Fe	Label: Mixed Packaging from responsible sources FSC C139032 2020 McDonalds Made in Argentina (34832) WRIN: 07626-042
119	ARG-PFAS-PP-05	Argentina	LAC	Paper wrapper for fried food	Fastfood paper wrapper	Whopper	Burger King - Fast food sudamericana S.A. / Córdoba 1628 Rosario, Santa Fe	-

ANNEX 3C: PHOTOGRAPHS OF LAB-ANALYZED PACKAGING AND TABLEWARE ITEMS

1 ZM-PFAS-PP-01

2 ZM-PFAS-PP-02

3 ZM-PFAS-CB-03

4 ZM-PFAS-MFP-04

5 TN-PFAS-PP02

6 TN-PFAS-PP-05

7 TN-PFAS-PP-06

8 TN-PFAS-PP-07

9 TN-PFAS-PP-08

10 TN-PFAS-PP-09

11 TW-PFAS-PP-03

12 TW-PFAS-PP-04

13 TW-PFAS-PP-05

14 TW-PFAS-MFP-03

15 TW-PFAS-MPB-01

16 TW-PFAS-MPB-02

17 TW-PFAS-RPP-01

18 TW-PFAS-RPP-02

19 PH-PFAS-PP-07

20 PH-PFAS-MFP-08

21 PH-PFAS-MFP-09

22 PH-PFAS-PP-11

23 PH-PFAS-PP-12

24 PH-PFAS-PP-13

25 PH-PFAS-PP-14

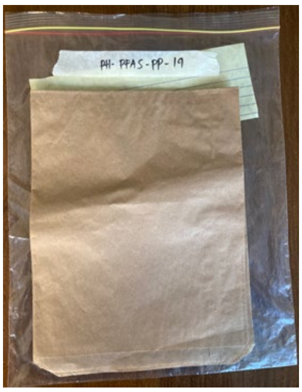
26 PH-PFAS-PP-15

27 PH-PFAS-PP-16

28 PH-PFAS-PP-17

29 PH-PFAS-PP-18

30 PH-PFAS-PP-19E



31 NP-PFAS-PP-01

32 NP-PFAS-PP-02

33 NP-PFAS-PP-04

34 NP-PFAS-PP-05

35 NP-PFAS-PP-06

36 NP-PFAS-PP-07

37 NP-PFAS-PP-08

38 NP-PFAS-PP-09

39 NP-PFAS-PP-10

40 MA-PFAS-PP-03

41 MA-PFAS-PP-04

42 MA-PFAS-PP-05

43 MA-PFAS-PP-09

44 MA-PFAS-PP-13

45 MA-PFAS-PP-14

46 JO-PFAS-PP-01A

47 JO-PFAS-PP-01B

48 JO-PFAS-PP-02

49 JO-PFAS-MFT-01

50 JO-PFAS-RPP-01

51 JO-PFAS-MPB-01

52 JO-PFAS-MPB-02

53 MNE-PFAS-PP-03

54 MNE-PFAS-MPB-01

55 MNE-PFAS-MPB-02

56 MNE-PFAS-RPP-01

57 MNE-PFAS-RPP-02

58 EG-PFAS-CB-01

59 EG-PFAS-MPB-01

60 EG-PFAS-MPB-02A

61 EG-PFAS-MPB-02B

62 EG-PFAS-MPB-02C

63 EG-PFAS-MPB-02D

64 EG-PFAS-MPB-02E

65 EG-PFAS-MPB-03A

66 EG-PFAS-MPB-03B

67 EG-PFAS-MPB-04A

68 EG-PFAS-MPB-04B

69 IQ-PFAS-PP-03

70 IQ-PFAS-PP-04

71 IQ-PFAS-CB-05

72 IQ-PFAS-RPP-03A

73 IQ-PFAS-RPP-03B

74 IQ-PFAS-RPP-03C

75 IQ-PFAS-MPB-01

76 IQ-PFAS-MPB-02

77 CMR-PFAS-PP-01

78 CMR-PFAS-RPP-06

79 CMR-PFAS-RPP-03

80 CMR-PFAS-PP-07

81 CMR-PFAS-RPP-04

82 KW-PFAS-PP-02

83 KW-PFAS-PP-04

84 KW-PFAS-PP-05

85 KW-PFAS-MFT-01

86 KW-PFAS-MPB-01

87 KW-PFAS-MPB-02

88 BN-PFAS-CB-01

89 BN-PFAS-PP-01

90 BN-PFAS-MFP-01

91 BN-PFAS-CB-07

92 BN-PFAS-CB-08

93 IN-PFAS-PP-01A

94 IN-PFAS-PP-01B

95 IN-PFAS-PP-02

96 IN-PFAS-PP-03

97 IN-PFAS-MFP-04

98 IN-PFAS-MPB-08

99 IN-PFAS-MPB-09

100 OUSANEG-PFAS-CB-01

101 OUSANEG-PFAS-CB-02

102 OUSANEG-PFAS-PP-05

103 OUSANEG-PFAS-MPB-6

104 OUSANEG-PFAS-RPP-8

105 OUSANEG-PFAS-RPP-9

106 OUSANEG-PFAS-RPP-10

107 OUSANEG-PFAS-PP-13

108 OUSANEG-PFAS-PP-18

109 OUSANEG-PFAS-CB-20

110 OUSANEG-PFAS-RPP-23

111 OUSANEG-PFAS-RPP-24

112 JM-PFAS-PP-01

113 JM-PFAS-PP-03

114 JM-PFAS-PP-05

115 JM-PFAS-PP-06

116 JM-PFAS-PP-08

117 ARG-PFAS-PP-01

118 ARG-PFAS-PP-04

119 ARG-PFAS-PP-05

ANNEX 4A: LABORATORY RESULTS (NG/G)

REGIONS

SA/EA/SEA...South, East, and South-East Asia
Africa..............Anglophone and Francophone Africa
MENA..............Middle East and North Africa
EE.....................Eastern Europe
LAC..................Latin America and Carribean

FAST FOOD CHAINS/COMPANIES

- Burger King
- KFC
- Subway
- McDonald's
- ACT II
- Burger Singh
- JOLLY TIME
- DUNKIN' DONUTS
- STARBUCKS

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
1	ZM-PFAS-PP-01	Zambia	Africa	<LOQ	21.4	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	14.8	6.6	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
2	ZM-PFAS-PP-02	Zambia	Africa	51 741	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
3	ZM-PFAS-CB-03	Zambia	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
4	ZM-PFAS-MFP-04	Zambia	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
5	TN-PFAS-PP-02	Tunisia	MENA	26 409	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
6	TN-PFAS-PP-05	Tunisia	MENA	162 192	1 847.1	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	1 847.1	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
7	TN-PFAS-PP-06	Tunisia	MENA	157 545	619.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	619.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
8	TN-PFAS-PP-07	Tunisia	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
9	TN-PFAS-PP-08	Tunisia	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
10	TN-PFAS-PP-09	Tunisia	MENA	330 397	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
11	TW-PFAS-PP-03	Taiwan	SA/EA/SEA	133 432	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
12	TW-PFAS-PP-04	Taiwan	SA/EA/SEA	10 047	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
13	TW-PFAS-PP-05	Taiwan	SA/EA/SEA	68 044	174.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	174.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
14	TW-PFAS-MFP-03	Taiwan	SA/EA/SEA	2 864 047	2 213.3	<LOQ	<LOQ	<LOQ	27.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	2 185.5	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
15	TW-PFAS-MPB-01	Taiwan	SA/EA/SEA	505 469	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
16	TW-PFAS-MPB-02	Taiwan	SA/EA/SEA	38 275	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
17	TW-PFAS-RPP-01	Taiwan	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
18	TW-PFAS-RPP-02	Taiwan	SA/EA/SEA	82 382	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
19	PH-PFAS-PP-07	Philip-pines	SA/EA/SEA	<LOQ	90.5	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	90.5	<LOQ
20	PH-PFAS-MFP-08	Philip-pines	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
21	PH-PFAS-MFP-09	Philip-pines	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
22	PH-PFAS-PP-11	Philip-pines	SA/EA/SEA	27 550 809	61 205.5	590.6	316.9	868.6	<LOQ	<LOQ	293.9	<LOQ	<LOQ	157.0	<LOQ	<LOQ	<LOQ	58 978.5	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
23	PH-PFAS-PP-12	Philip-pines	SA/EA/SEA	1 990 212	6442.1	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	6 442.1	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
24	PH-PFAS-PP-13	Philip-pines	SA/EA/SEA	21 697	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
25	PH-PFAS-PP-14	Philip-pines	SA/EA/SEA	144 398	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
26	PH-PFAS-PP-15	Philip-pines	SA/EA/SEA	171 795	311.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	311.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
27	PH-PFAS-PP-16	Philip-pines	SA/EA/SEA	154 832	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
28	PH-PFAS-PP-17	Philip-pines	SA/EA/SEA	206 414	797.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	797.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
29	PH-PFAS-PP-18	Philippines	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
30	PH-PFAS-PP-19E	Philippines	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
31	NP-PFAS-PP-01	Nepal	SA/EA/SEA	45 274	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
32	NP-PFAS-PP-02	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
33	NP-PFAS-PP-04	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
34	NP-PFAS-PP-05	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
35	NP-PFAS-PP-06	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
36	NP-PFAS-PP-07	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
37	NP-PFAS-PP-08	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
38	NP-PFAS-PP-09	Nepal	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
39	NP-PFAS-PP-10	Nepal	SA/EA/SEA	<LOQ	80.4	<LOQ	<LOQ	80.4	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
40	MA-PFAS-PP-03	Marocco	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
41	MA-PFAS-PP-04	Marocco	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
42	MA-PFAS-PP-05	Marocco	MENA	9 480	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
43	MA-PFAS-PP-09	Marocco	MENA	203 622	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
44	MA-PFAS-PP-13	Marocco	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
45	MA-PFAS-PP-14	Marocco	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
46	JO-PFAS-PP-01A	Jordan	MENA	196 960	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
47	JO-PFAS-PP-01B	Jordan	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
48	JO-PFAS-PP-02	Jordan	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
49	JO-PFAS-MFT-01	Jordan	MENA	10 373 773	3 771.2	<LOQ	<LOQ	220.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	3 550.5	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
50	JO-PFAS-RPP-01	Jordan	MENA	71 134	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
51	JO-PFAS-MPB-01	Jordan	MENA	668 407	7 181.5	<LOQ	<LOQ	11.0	50.7	31.8	16.6	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	4 978.2	2 093.2	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
52	JO-PFAS-MPB-02	Jordan	MENA	580 780	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
53	MNE-PFAS-PP-03	Podgor-ica	EE	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
54	MNE-PFAS-MPB-01	Podgor-ica	EE	464 968	612.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	612.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
55	MNE-PFAS-MPB-02	Podgor-ica	EE	211 453	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
56	MNE-PFAS-RPP-01	Podgor-ica	EE	29 901	825.9	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	768.8	<LOQ	<LOQ	<LOQ	17.5	<LOQ	<LOQ	39.5	<LOQ
57	MNE-PFAS-RPP-02	Podgor-ica	EE	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
58	EG-PFAS-CB-01	Egypt	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
59	EG-PFAS-MPB-01	Egypt	MENA	670 555	714.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	714.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
60	EG-PFAS-MPB-02A	Egypt	MENA	375 140	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
61	EG-PFAS-MPB-02B	Egypt	MENA	411 461	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
62	EG-PFAS-MPB-02C	Egypt	MENA	468 971	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
63	EG-PFAS-MPB-02D	Egypt	MENA	353 059	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
64	EG-PFAS-MPB-02E	Egypt	MENA	520 845	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
65	EG-PFAS-MPB-03A	Egypt	MENA	374 536	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
66	EG-PFAS-MPB-03B	Egypt	MENA	137 100	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
67	EG-PFAS-MPB-04A	Egypt	MENA	395 226	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
68	EG-PFAS-MPB-04B	Egypt	MENA	358 397	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
69	IQ-PFAS-PP-03	Iraq	MENA	16 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
70	IQ-PFAS-PP-04	Iraq	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
71	IQ-PFAS-CB-05	Iraq	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
72	IQ-PFAS-RPP-03A	Iraq	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
73	IQ-PFAS-RPP-03B	Iraq	MENA	<LOQ	62.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	62.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
74	IQ-PFAS-RPP-03C	Iraq	MENA	<LOQ	47.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	47.3	<LOQ	<LOQ	<LOQ
75	IQ-PFAS-MPB-01	Iraq	MENA	3 056	4 851.3	<LOQ	<LOQ	9.5	44.2	35.6	14.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	3 497.4	1250.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
76	IQ-PFAS-MPB-02	Iraq	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
77	CMR-PFAS-PP-01	Cameroon	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
78	CMR-PFAS-RPP-06	Cameroon	Africa	<LOQ	422.9	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	115.5	193.1	114.3	<LOQ
79	CMR-PFAS-RPP-03	Cameroon	Africa	<LOQ	427.2	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	135.7	136.8	154.7	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
80	CMR-PFAS-PP-07	Cameroon	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
81	CMR-PFAS-RPP-04	Cameroon	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
82	KW-PFAS-PP-02	Kuwait	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
83	KW-PFAS-PP-04	Kuwait	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
84	KW-PFAS-PP-05	Kuwait	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
85	KW-PFAS-MFT-01	Kuwait	MENA	<LOQ	5 887.2	<LOQ	<LOQ	228.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	5 658.9	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
86	KW-PFAS-MPB-01	Kuwait	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
87	KW-PFAS-MPB-02	Kuwait	MENA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
88	BN-PFAS-CB-01	Benin	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
89	BN-PFAS-PP-01	Benin	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
90	BN-PFAS-MFP-01	Benin	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
91	BN-PFAS-CB-07	Benin	Africa	<LOQ	173.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	173.3
92	BN-PFAS-CB-08	Benin	Africa	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
93	IN-PFAS-PP-01A	India	SA/EA/SEA	<LOQ	286.7	31.9	34.2	210.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	9.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
94	IN-PFAS-PP-01B	India	SA/EA/SEA	<LOQ	76.2	48.3	<LOQ	23.9	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	4.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
95	IN-PFAS-PP-02	India	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
96	IN-PFAS-PP-03	India	SA/EA/SEA	<LOQ	29.3	<LOQ	<LOQ	29.3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
97	IN-PFAS-MFP-04	India	SA/EA/SEA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
98	IN-PFAS-MPB-08	India	SA/EA/SEA	13 622	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
99	IN-PFAS-MPB-09	India	SA/EA/SEA	26 063	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
100	OUSANEG-PFAS-CB-01	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
101	OUSANEG-PFAS-CB-02	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
102	OUSANEG-PFAS-PP-05	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
103	OUSANEG-PFAS-MPB-6	Mexico	LAC	<LOQ	560.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	560.8	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
104	OUSANEG-PFAS-RPP-8	Mexico	LAC	<LOQ	417.4	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	206.4	67.1	143.8	<LOQ
105	OUSANEG-PFAS-RPP-9	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
106	OUSANEG-PFAS-RPP-10	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
107	OUSANEG-PFAS-PP-13	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
108	OUSANEG-PFAS-PP-18	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
109	OUSANEG-PFAS-CB-20	Mexico	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
110	OUSANEG-PFAS-RPP-23	Mexico	LAC	<LOQ	203.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	203.0	<LOQ	<LOQ	<LOQ
111	OUSANEG-PFAS-RPP-24	Mexico	LAC	<LOQ	4.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	4.7	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

#Photo	Sample ID	Country	Region	EOF	suma PFAS	PFBA	PF-PeA	PF-HxA	PFOA	PFDA	PF-DoA	PFBS	PFDS	5:3 FTA	n-Et-FOSAA	8:2 FTS	10:2 FTS	6:2 FTOH	8:2 FTOH	10:2 FTOH	6:2 PAP	8:2 PAP	6:2/6:2 diPAP	6:2/8:2 diPAP	8:2/8:2 diPAP	Cl-PF-HxPA
112	JM-PFAS-PP-01	Jamaica	LAC	<LOQ	290.2	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	216.2	<LOQ	74.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
113	JM-PFAS-PP-03	Jamaica	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
114	JM-PFAS-PP-05	Jamaica	LAC	<LOQ	1 453.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	1453.0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
115	JM-PFAS-PP-06	Jamaica	LAC	<LOQ	321.2	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	321.2	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
116	JM-PFAS-PP-08	Jamaica	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
117	ARG-PFAS-PP-01	Argentina	LAC	<LOQ	777.4	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	777.4	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
118	ARG-PFAS-PP-04	Argentina	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
119	ARG-PFAS-PP-05	Argentina	LAC	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

ANNEX 4B: SUMMARY RESULTS PER GEOGRAPHIC REGION

	South, East, and South-East Asia (SA/EA/SEA; 36 samples)	Middle East and North Africa (MENA; 44 samples)	Africa (14 samples)	Latin America and the Caribbean (LAC; 20 samples)	Eastern Europe (EE; 5)
PFAS positive samples (EOF > 0 and/or individual PFAS > 0)	22 (61%)	26 (59%)	5 (36%)	8 (40%)	3 (60%)
Median/maximum EOF calculated from samples above LOQ (ppm)	133/27 551	353/10 374	52/52	<LOQ	211/465
Median/maximum sum of targeted PFAS calculated from samples above LOQ (ppb)	287/61 206	1 847/7 182	298/427	369/1 453	719/826
Intentional PFAS treatment (EOF > 20 ppm calculated from EOF positive samples)	15/17 (88%)	20/23 (87%)	1/1 (100%)	<LOQ	3/3 (100%)
PFOA>25ppb (EU POPs Directive)	1	2	0	0	0
Sum long-chain PFCAs>25ppb (EU REACH legislation)	1	2	0	0	0
Does not meet at least one condition of the universal PFAS REACH proposal	16	23	4	7	2
Most frequent PFAS	6:2 FTOH	6:2 FTOH	Cl-PFHxPA	6:2 FTOH	6:2 FTOH
PFAS with the highest concentration	6:2 FTOH	6:2 FTOH	FTSs, diPAPs	6:2 FTOH	6:2 FTOH

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