Malaysia PFAS Situation Report

Consumers Association of Penang
March 2019

Summary

This report summarizes press reports and scientific studies on per- and polyfluoroalkyl substances (PFAS) in Malaysia. The country has not yet ratified the Stockholm Convention which listed PFOS for global restriction in 2009. Despite this, there has been steady press reporting on PFAS substances, primarily related to non-stick cookware.

Scientific studies of PFAS and examination of regulatory policy in Malaysia raise concerns about these substances and reinforces the need for regulatory action:

No regulations control PFAS substances in Malaysia

No PFAS substances are regulated in the country The Stockholm Convention added PFOS to its global restriction list in 2009, but Malaysia is not yet a Party to the treaty, so even this POP is not regulated or part of any elimination plan.

Breast milk is contaminated with PFAS substances

A 2008 study found PFOS levels in Malaysian breast milk averaged 121 ppt – more than 6 times higher than the drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined in the US State of Vermont. The highest level of PFOS in Malaysian breast milk was more than 17 times higher than this drinking water health advisory limit.

PFOS, PFHxS, and PFOSA were found in human blood in Malaysia in 2004

Reported levels of PFAS in blood in Malaysia were 12.7 ppb PFOS, 1.98 ppb PFHxS, and 4.57 ppb PFOSA. PFOA was not detected in blood at this time. These levels and those reported in other countries far exceed modern drinking water standards for these substances. For example, 12.7 ppb PFOS is 12,700 ppt vs. 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined health advisory limit in the US State of Vermont.

PFAS contaminates coastal water

A 2017 study found Malaysia (and Philippines to be a likely source of PFAS pollution in the South China Sea. A 2011 study found high levels of PFAS contamination near the causeway connecting the Singapore Island and the Malay Peninsula across the Johor Strait where an industrial wastewater treatment plant discharges its effluent.

Drinking water supplies are polluted with PFAS

The Langat River is an important drinking water source for Selangor – a state with nearly six million people and the economic engine of Malaysia. A 2012 study found very high levels of PFOA and PFOS in the river, vastly exceeding US state regulatory limits.

Actions to control and phase-out PFAS as a class contribute to achievement of several key Sustainable Development Goals (SDGs) due to the impacts of the substances on health and ecosystems including water pollution. These include SDGs 3, 6, 9, 12, 14, 15, and 16.

What are per- and polyfluoroalkyl substances (PFAS)?

PFAS is a large class of more than 4,500 persistent fluorinated chemicals. Two widely-used members of this class have been perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). As these two substances have come under regulatory pressure, the industry has shifted to other PFAS with similar properties.

Human exposure to PFAS is mainly by ingestion of contaminated food or water. These substances bind to proteins (not to fats) and persist in the body where they are mainly detected in blood, liver and kidneys. Studies indicate that PFOA and PFOS can cause reproductive and developmental, liver and kidney, and immunological effects in laboratory animals. Both chemicals cause tumors in animal studies along with a variety of other effects on infant birth weight, growth, learning, infant behavior, pregnancy, endocrine system, increased cholesterol, and thyroid function. Recent studies have linked a variety of PFAS substances to many human health effects: cardiovascular disease, markers of asthma, damage to semen quality, ovarian insufficiency, altered glucose metabolism, lower testosterone levels in male adolescents, association with shorter birth length in girls, elevated blood pressure, abnormal menstruation, lower birth weight in infants, possible increased risk of female infertility due to endometriosis, and decreased lung function in children with asthma.

The manufacture of PFAS and their use in a multitude of products has caused widespread pollution. PFAS are found in wildlife, accumulating in the blood, liver and kidneys of wildlife such as dolphins, polar bears, seals, birds, fish, and other marine wildlife. PFAS substitutes for PFOS and PFOA have been identified as potential global surface water contaminants and they have been found in more than 80% of 30 surface seawater samples from the North Pacific to Arctic Ocean. PFAS use in firefighting foams at military bases and airports is responsible for water pollution and contaminated communities in many countries, including Australia, Canada, China, Germany, Italy, Japan, Netherlands, New Zealand, South Korea, and Sweden.

Safer cost competitive non-fluorinated alternatives for PFAS use in firefighting foams have been adopted by an increasing number of major airports, including Auckland, Copenhagen, Dubai, Dortmund, Stuttgart, London Heathrow, Manchester, and all 27 major airports in Australia. Increasing awareness about the negative characteristics of PFAS has driven efforts to identify and market safer substitutes for other uses. Due to the complexity and negative characteristics of PFAS, there is increasing interest in regulating PFAS as a class rather than as individual substances.

PFOS

PFOS and its related substances have been used in a variety of products and processes including firefighting foams, carpets, leather goods, upholstery, packaging, industrial and household cleaning products, pesticides, photographic applications, semiconductor manufacturing, hydraulic fluids, catheters and metal plating. PFOS is extremely persistent and has shown no degradation under any environmental condition that has been tested. It is toxic to mammals and high concentrations have been found in Arctic animals, far from anthropogenic sources. PFOS is regularly detected in human blood and breast milk. For example, in one study of 299 infants, PFOS was found in the blood of 297 of them and PFOA was found in all of them.

PFOA

PFOA has been used to make non-stick pans, and is found in textiles, fire-fighting foams, and medical devices, and is used in many other products and processes. In 2017, the Stockholm Convention POPs Review Committee noted the link between PFOA and serious illnesses in humans, including diagnosed high cholesterol, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer and pregnancy-induced hypertension. PFOA has contaminated the global environment, including wildlife and people of remote regions such as the Arctic and Antarctic.

For more information about recent research on the impacts of PFAS, including fluorinated substitutes for PFOS and PFOA, please see Annex 1. Information about the high cost of PFAS pollution cleanup is available in Annex 2. Global regulation of PFAS through the Stockholm Convention and evaluations of its expert committee is discussed in Annex 3.

Actions on PFAS and the Sustainable Development Goals

Actions to control and phase-out PFAS as a class contribute to achievement of several key Sustainable Development Goals (SDGs) due to the impacts of the substances on health and ecosystems including water pollution. These include

Sustainable Development Goal 3: Ensure healthy lives and promote well-being for all at all ages. Targets under SDG3 include:
3.4: *"reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being"*
3.9: *"substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination."*

Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all. Targets under SDG6 include:
6.3: *"improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."*

Sustainable Development Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. Targets under SDG9 include:
9.4: *"greater adoption of clean and environmentally sound technologies and industrial processes."*

Sustainable Development Goal 12: Ensure sustainable consumption and production patterns. Targets under SDG12 include:
12.4: *"By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frame works, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment."*

12.5: *"substantially reduce waste generation through prevention, reduction, recycling and reuse."*
12.6: *"Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle."*
12.7: *"Promote public procurement practices that are sustainable, in accordance with national policies and priorities."*

Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development. Targets under SDG14 include:
14.1: *"By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution."*

Sustainable Development Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Targets under SDG15 include:
15.1: *"By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements."*
15.5: *"Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species."*
15.9: *"By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts."*

Sustainable Development Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels. Targets under SDG16 include:
16.7: *"Ensure responsive, inclusive, participatory and representative decision-making at all levels."*
16.10: *"Ensure public access to information…"*

Scientific studies on PFAS in Malaysia cited in journals

Distribution profiles of per- and poly fluoroalkyl substances (PFASs) and their re-regulation by ocean currents in the East and South China Sea

https://www.researchgate.net/publication/319010172 . Marine Pollution Bulletin 125(1-2) · August 2017.
Authors: Hongyuan Zheng, Feng Wang, Zhen Zhao, Yuxin Ma, Haizhen Yang, Zhibo Lu, Minggang Cai, Minghong Cai

The study investigated the distribution of 17 individual per- and polyfluoroalkyl substances (PFASs) in 42 surface water samples collected from the East and South China Sea. Seven PFAS were detected: PFBS, PFHxS, PFPA, PFHxA, PFHpA, PFOA, and FOSA. PFAS levels are higher in the East China Sea than the South China Sea.

PFOA was the most predominant PFAS in samples from the East China Sea, and was measured in half of the samples, followed by PFBS (14%) and PFHxA (13%). PFOA levels ranged up to 1289 pg/L. FOSA was the most predominant PFAS in samples from the South China Sea, and was measured in 65% of the samples, followed by PFOA in 35% of the samples.

Discharges from the flourishing tourism industry in the coastal regions of Philippines and Malaysia, and rivers, such as the Mekong River, are potential sources of PFAS in the South China Sea.

Impacts of Perfluorinated Compounds on Human Health

https://pdfs.semanticscholar.org/b67b/5cbff888880d2597fe4a8b743bc58df4dcd9.pdf . Bulletin of Environment, Pharmacology and Life Sciences Vol 4 [7] June 2015: 183-191. Authors: Sunantha Ganesan and Namasivayam Vasudevan

A review of PFCs which managed to be detected almost ubiquitously in water, different kinds of foodstuffs, fish, birds, as well as in human breast milk, blood and umbilical cord blood. There is evidence which shows the strong link between the presence of that PFCs to a variety of disorders including diabetes, cerebrovascular disease, neurotoxicity, immune deficiency and cancer. PFOA and PFOS both cross the placental barrier and "exposure of the developing human fetus to these compounds is inevitable. Exposure to the fetus, infants, and children are of the greatest concern as these are the most sensitive stages of human development." In Malaysia, and other countries, blood PFOS concentrations were in the range 3 to 29 µg/L. The lowest PFOS concentrations were measured in samples from India (< 3 µg/L). In this study, the PFOA concentrations were lower than the values for PFOS, except in India and Korea.

Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) in Surface Water From the Langat River, Peninsular Malaysia

https://www.researchgate.net/publication/232380893
Environmental Forensics 13(1) · March 2012. Authors: Nguyen Pham Hong LIEN, Shigeo FUJII, Shuhei TANAKA, Munehiro NOZOE, Wanpen WIROJANAGUD, Ann ANTON, Gunilla LINDSTROM

This journal highlights how no studies had addressed PFOA and PFOS and no regulations had been developed to control these compounds in Malaysia. Thus, this study was conducted in order to provide a baseline of the presence and environmental values of PFOA and PFOS in Langat River, Malaysia – one of the most polluted rivers in Malaysia and located in a rapidly developing area.

The results showed extremely high PFAS levels in the river. Average PFOA levels ranged up to 5940 ppt and the highest PFOS levels reached 43,500 ppt. In contrast, the US state of Vermont has a drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined. The highest level of PFOA is nearly 300 times higher than this limit and the highest PFOS level is more than 2000 times higher than this health advisory limit in Vermont.

The authors note that PFAS pollution in the river may be due to a effluents from a nearby landfill. Another source at a different sampling site is a wastewater retention pond from an industrial area that discharges directly into the river. A third source is recreational and camping activities at an area along the river.

The study notes that PFAS levels observed in the Langat River are higher than those found in the US (Tennessee River), Japan (Yodo River), India (Couum River), and the coastal waters of Hong Kong, South China and Korea.

The Langat River is an important drinking water source for Selangor – a state with nearly six million people and the economic engine of Malaysia.

Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) in Water Environment of Singapore https://www.researchgate.net/publication/225733380. Water Air and Soil Pollution 216(1):179-191 · March 2011. Authors: Jiangyong Hu, Jing Yu, Shuhei Tanaka, Shigeo Fujii

The article was done to characterize the spatial distribution and seasonal variation of PFOS and PFOA in the aquatic and oceanic environment of Singapore where more than 100 water samples from reservoirs, rivers/canals etc were tested including from the Johor Straits, Malaysia. PFOS (1.9 – 8.9 ng/L) and PFOA (2.4 – 17.8 ng/L) were detected in all coastal waters. These levels were higher than those found in Hong Kong coastal waters. PFOS and PFOA were also found in all samples from reservoirs, rivers/canals, and treated effluents from wastewater treatment plants around the island.

Compared with surface waters and wastewaters, coastal waters had lower concentrations of PFOS and PFOA. The highest PFOS and PFOA concentration as well as total PFCs concentration in coastal waters were detected near the causeway connecting the Singapore Island and the Malay Peninsula across the Johor Strait. It suggests that Johor Straits is more heavily contaminated than the southern and eastern coastal waters. The authors note that “Industries in the northwestern area may be the significant contamination sources for Johor Straits since W2 [industrial wastewater treatment plant] discharges it effluent nearby.”

The second highest PFAS levels were found adjacent to the airport, indicating pollution from use of PFAS-containing firefighting foams.

The emergence of persistent organic pollutants in the environment: the occurrence and treatment of perfluorinated compounds
https://www.researchgate.net/publication/277062530. April 2011. Authors: Chinagarn Kunacheva, S.T.M.L.D. Senevirathna, Shuhei Tanaka, Shigeo Fujii, Nguyen Pham Hong Lien, Munehiro Nozoe, Binaya Raj Shivakoti. Self-published

This comprehensive literature review describes PFC contamination in river, tap and bottled water in Japan and other countries, including Canada, China, Malaysia, Sweden, Thailand and Vietnam. Observed levels of PFOS and PFOA were reported in the ranges of non-detectable to 13.2 ng/L (ppt) and non-detectable to 109 ng/L (ppt) respectively. It is also reported that conventional technologies used in wastewater treatment plants do not remove PFAS substances adequately. For example, the authors note that water treatment plants in Bangkok removed less than 50% of the PFAS substances. The authors claim that reverse osmosis techniques can removed 99% of PFOS and that use of polymeric resin system such as Amberlite XAD4 can remove 99.99% of PFOS. However, there are many other common PFAS pollutants besides PFOS and the authors note that these technologies have yet to be applied commercially. Finally, the authors state that harmless or less harmful alternatives to PFAS "should also be made a top priority."

Distribution of perfluorochemicals between sera and milk from the same mothers and implications for prenatal and postnatal exposures

https://doi.org/10.1016/j.envpol.2010.09.008. Environmental Pollution Volume 159, Issue 1, January 2011, Pages 169-174. Authors: Seung-Kyu Kim, Kyu Tae Lee, Chang Seong Kang, Lin Tao, Kurunthachalam Kannan, Kyung-Ryul Kim, Chan-Kook Kim, Jung Suk Lee, Pan Soo Park, Yung Wook Yoo, Jeong Yi Ha, Yong-Seung Shin, Jong-Hyeon Lee

Samples of maternal serum, umbilical cord serum, and breast milk from Korean women were used to measure PFAS levels in this study. The average daily intakes of PFAS by Korean infants were in the lower ranges than other Asian countries including Malaysia where the average daily intake of PFOS was estimated to be 15.0 ng/kg/day.

Levels, temporal trends, and tissue distribution of perfluorinated surfactants in freshwater fish from Asian countries https://www.ncbi.nlm.nih.gov/pubmed/21424221 . Arch Environ Contam Toxicol. Authors: Murakami M1, Adachi N, Saha M, Morita C, Takada H. 2011
The PFAS content of freshwater fish was measured in samples of carp, snakehead, and catfish from India, Japan, Vietnam, Malaysia, and Thailand. Samples from Malaysia were from Selangor (snakehead). PFOS varied from <LOQ to 0.2 ng/g wet weight and PFUA varied from <LOQ to 0.1 ng/g wet weight. In fish liver, PFOS levels increased to 3 ng/g wet weight. Samples from Vietnam were higher than those from India and Malaysia.

Contamination, bioaccumulation and toxic effects of perfluorinated chemicals (PFCs) in the water environment: A review paper

https://www.researchgate.net/publication/26817129
Water Science & Technology 60(6):1533-44 · September 2009. Authors: Fatihah Suja, Biplob Kumar Pramanik, Shahrom Md Zain

The authors note that PFAS pollution is an emerging concern and that water is "the most non-biota environmental compartment of concern" due to the solubility of these substances in water. The paper focuses on the distribution, bioaccumulation and toxic effects of PFOS and PFOA in the water. Based on previous studies of samples collected in several countries, surface water, ground water and drinking water were polluted by PFAS which showed positive correlation with PFAS contamination in biota and human blood. The review cites 2005 and 2006 data from surface water sampled in Kota Kinabalu – the capital of Sabah State. PFOS levels ranged from undetected – 3.4 ppt and PFOA levels varied from undetected to 3.2 ppt. PFOA and PFOA were hardly detected in collected tap water samples in Penang and Kota Kinabalu in 2005. Despite these seemingly low levels, the review cites 2004 data showing significant levels of PFOS in human serum in Malaysia of 12.4 ng/ml (ppb).

Perfluorinated Compounds in Human Breast Milk from Several Asian Countries, and in Infant Formula and Dairy Milk from the United States

http://environmentportal.in/files/Perfluorinated%20Compounds%20in%20Human%20Breast%20Milk.pdf

Environment Science & Technology. Volume 42. pp 8597 - 8602. 2008 Authors: Lin Tao, Jing Ma, Tatsuya Kunisue, E. Laurence Libelo, Shinsuke Tanabe, and Kurunthachalam Kannan

In this study, breast milk collected from seven countries in Asia (including Penang, Malaysia) was analysed for PFAS including PFOS, PFOA and their fluorinated substitutes. PFOS was found in every Malaysian woman sampled and PFHxS was present in 85% of them. Other PFAS substances found in Malaysian breast milk included PFOA, PFNA, and PFBS. The median PFOS concentrations in the milk of Malaysian and Cambodian mothers, who were nursing for the first time were 27-100% higher than concentrations in the milk of mothers who had previously nursed, from the same countries.

Overall, average PFOS levels in Malaysian breast milk averaged 121 ppt – more than 6 times higher than the drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined in the US State of Vermont. The highest level of PFOS in Malaysian breast milk was more than 17 times higher than this drinking water health advisory limit.

PFAS levels in Malaysian breast milk from Penang

n = 13 Overall mean PFOS level = 121 ppt

Substance	Range (ppt)	Fraction of samples containing (%)
PFOS	49 – 350	100
PFOA	<43 – 90	23
PFHxS	<2 – 13	85
PFNA	<9 – 15	8
PFBS	<1 – 17	8
PFHpA	<4	0

Perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) contamination of water environment in Asian countries http://hdl.handle.net/11094/13247 . 2008. Authors: Fujii, S; N, P.H. Lien; H, T. Hai; Tanaka, S; Chinagarn, K; Nozoe, M; Kimura, K; Wirojanagud, W; Anton, A; J, Y. Hu; Guan, Y; Mizuno, T; Suwanna, K; Y, H. Liou

In this study, water samples from Johor Bahru and Kota Kinabalu, Malaysia (one of the six Asian countries) was taken for testing of PFOS and PFAS contamination in water. Their aqueous concentrations were analyzed by solid phase extraction (SPE) coupled with LC/MS measurement. The majority of surface tap water samples were contaminated with them at concentrations above the *limit of qualification (LOQs).* Water in industrialized and urbanized areas were generally more contaminated. Tap water was generally contaminated with PFOS and PFOA at concentration levels similar to those found in their corresponding environmental water.

New POPs in the water environment: Distribution, bioaccumulation and treatment of perfluorinated compounds - A review paper

https://www.researchgate.net/publication/32170787
Aqua 56(5) · August 2007. Authors: Shigeo Fujii, Chongrak Polprasert, Shuhei Tanaka, Nguyen Pham Hong Lien, Yong Qiu

This literature review paper note that global production of one PFAS class (PFCAs) up to 2006 was 4,400 – 8,000 tons and that global emissions to the environment during this period were 3,200 – 7,300 tons. The review shows that tap and surface water samples in several countries were found to be contaminated with PFOS and PFOA such as cities in Canada, China, Malaysia, Sweden, Thailand and Vietnam. Levels of PFOS and PFOA were in the ranges of ND-13.2 ng/L (ppt) and ND-109 ng/L (ppt), respectively. The presence of these compounds in tap water, surface water, blood indicates global contamination and bioaccumulative phenomena in the ecosystems.

Perfluorinated substances in tap water of Japan and several countries and their relationship to surface water contamination.

https://www.jstage.jst.go.jp/article/proes1992/43/0/43_0_611/_pdf . Environmental Engineering Research, Vol. 43, 2006. Authors: Nguyen Pham Hong Lien, Shigeo Fujii, Shuhei Tanaka, Munehiro Nozoe, Wanpen Wirojanagud, Ann Anton And Gunilla Lindstrom

This study measured concentrations of PFOS and PFOA in 38 tap water samples collected from several areas including Penang and Kota Kinabalau, Malaysia and conducted a systematic survey of PFOS and PFOA at surrounding surface water sites. In samples from Penang and Kota Kinabalu, PFOS levels ranged from undetected – 3.4 ppt and PFOA levels varied from undetected to 3.2 ppt.. Most of collected tap water samples were contaminated with PFOS and PFOA where the level of tap water concentrations was generally related to the level of surrounding surface water concentrations whether the source of tap water was the surface water or not.

Perfluorooctanesulfonate and Related Fluorochemicals in Human Blood Samples from China

https://pdfs.semanticscholar.org/137d/a9c459d7ae4aa1991354236bc5fa4ec23c61.pdf. Environ. Sci. Technol. 40, 715-720. 2006. Authors: Leo W. Y. Yeung, M. K. So, Guibin Jiang, S. Taniyasu, N. Yamashita, Maoyong Song, Yongning Wu, Jingguang Li, J. P. Giesy, K. S. Guruge, Paul K. S. Lam

In this study, concentrations of PFHxS, were measured in 85 samples of whole human blood collected from nine cities (eight provinces) in China. Studies of occurrence of PFOS, PFOA, and related fluorochemicals in human blood were cited from the United States, Columbia, Brazil, Italy, Poland, Belgium, India, Malaysia, Korea, Japan, and Sri Lanka. The study referenced 2004 data on PFAS in blood Malaysia. Reported levels were 12.7 ppb PFOS, 1.98 ppb PFHxS, and

4.57 ppb PFOSA. PFOA was not detected in blood at this time. These levels and those reported in other countries far exceed modern drinking water standards for these substances. For example, 12.7 ppb PFOS is 12,700 ppt vs. [20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined] health advisory limit in the US State of Vermont. The authors noted that the results indicate the widespread presence of PFAS in the general population.

CAP's Newsletter Utusan Konsumer mentioned PFOA

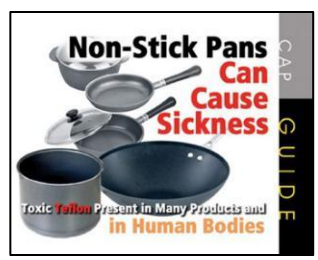
Humankind Polluted – Over 300 Chemicals Found in Our Blood (UK Jan-Feb 2007)

The article is about how the average person today has almost 300 toxic chemicals in his or her blood. These chemicals are capable of causing various health hazards ranging from liver damage to cancer. Among the chemicals mentioned in the article is PFOA from non-stick coatings.

Chemicalised Clothes (UK Jan-Feb 2012)

According to the article over 8,000 synthetic chemicals are used to produce garments that are worn on the human body. Many of which are classified by the WHO as moderately to extremely hazardous and are linked to cancers, birth defects and reproductive problems. Among the chemicals present in man-made fabrics is perfluorinated chemicals (PFCs) the same materials used in Teflon cooking products to give fabrics a no-iron quality.

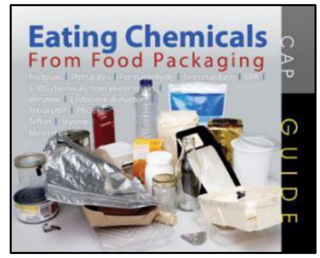
CAP's Publication that mentioned PFOA



Non-Stick Pans Can Cause Sickness

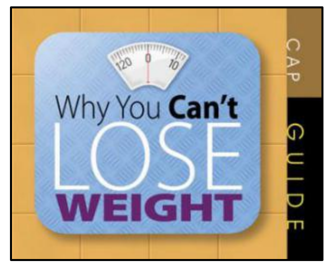
After over 50 years of use worldwide, many questions are being raised about Teflon's possible long term health effects. The pamphlet explains about the nature of Teflon, where it is found and the health hazards associated with the chemical.

Eating Chemicals from Food Packaging



Over 4,000 toxic chemicals are intentionally used in food packaging, storage, processing and preparation. Out of which only 25% are tested for toxicity. Consumers are unknowingly exposed to tiny amounts of these chemicals daily which over a lifetime can lead to undesirable health effects such as obesity, diabetes and cancer. Among the products mentioned is greaseproof wrapping which can leach polyfluoroalkyl phosphate esters or PAPs. This chemical can migrate into food, when ingested and enter the body they break down into perfluorooctanoic acid (PFOA)

Why You Can't Lose Weight



The guidebook title Why You Can't Lose Weight touches on Obesogens - chemicals that can make one fat. Among the chemicals mentioned is PFOA which is found in non-stick (Teflon) pots and pans, microwave popcorn bags and the packaging of other microwavable foods, carpets and paints.

Press reports on PFAS in Malaysia

Non-stick chemicals common in fast food packaging, says study (2017)
https://www.freemalaysiatoday.com/.../non-stick-chemicals-common-in-fast-food-pac...

Feb 2, 2017 - Free *Malaysia* Today ... chemicals used in stain-resistant carpets, *non-stick cookware* and ... The study did not show any specific *harm* to human health from ... their developing bodies are more vulnerable to toxic chemicals.".

Dangers of Cookware, Safe Alternatives | Care 2 Healthy Living
https://www.care2.com/greenliving/dangers-of-cookware-safe-alternatives.html
Mar 12, 2009 - I remember the first time I cooked eggs in a *Teflon* skillet, without a lick of butter those eggs slipped and scooted all around the *pan* like kids on ...

PressReader – The Star Malaysia – Star2 : 2017-11-26 – Excellent …
https://www.pressreader.com/malaysia/the-star-malaysia-star2/.../282029032540122
Nov 26, 2017 - It uses Tritanium Ultra Plus, which has five layers of *non-stick* coating ... This increasingly popular Shogun *non-stick cookware* can be found in all ... As mothers, we try all means to protect our loved ones from *harm* and keep ...

A sticky Situation With Non-Stick Chemicals | Star2.com
https://www.star2.com › TSOL - Environment

Jul 5, 2018 - *Non-stick* chemicals such as PFAS, which are used in various items from water-resistant materials to *cookware*, have been found to be more dangerous to our ... break off and end up in the food chain, causing health *problems* from high cholesterol to cancer. .... Take a deep breath: Lung cancer in *Malaysia* ...

PFAS regulations

PFAS substances are not currently regulated in Malaysia. Stockholm Convention ratification would help trigger national regulation of PFOS and PFOA when it is listed in 2019.

PFAS regulations in other countries

Most PFAS are not regulated, but PFOA and PFOS have come under regulatory scrutiny, particularly in the US where a large number of contaminated drinking water sites have been identified. In 2016, the US established a federal health advisory limit in drinking water of 70 ppt (parts per trillion) for PFOA and PFOS combined. This advisory limit is not enforceable but is used as a guideline. A recent US government review by the Agency for Toxic Substances and Disease Registry has proposed tightening exposures which would translate to drinking water limits of 7 ppt for PFOS and 11 ppt for PFOA.

In the absence of federal regulations, individual US states (California Colorado, Minnesota, Michigan, New Jersey, New Mexico, Texas, Vermont, and Washington) have moved forward to regulate PFAS in drinking water, firefighting foam, personal protective equipment and wastes. Another 11 states are considering or have already proposed similar regulatory actions. Information about individual state proposals can be obtained here.

In 2018, state regulators in California set interim notification limits of 13 ppt for PFOS and 14 ppt for PFOA in drinking water. Regulators noted that both substances were listed by the state as developmental toxicants and that the National Toxicology Program concluded that both substances are “presumed to be an immune hazard to humans.” Colorado uses a 70 ppt combined limit of PFOS and PFOA as a groundwater quality standard. Colorado also regulates PFOS and PFOA as hazardous waste. Massachusetts sets a 70 ppt limit for PFOA, PFOS, PFHxS, PFNA and PFHpA combined. Michigan uses the federal 70 ppt combined PFOS and PFOA standard as a limit for drinking water. The Minnesota Department of health recommends the following guidance values: 2000 ppt for PFBS, 27 ppt for PFHxS, 27 ppt for PFOS, 7000 ppt for PFBA, and 35 ppt for PFOA. New Jersey added PFNA to its hazardous substances list and set a limit for PFNA of 13 ppt in drinking water. New Jersey proposed limits of 14 ppt for PFOA and 13 ppt for PFOS. Vermont sets a drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined. In 2018, Washington banned PFAS in firefighting foams and personal protective equipment and began a rulemaking process to established drinking water limits. The New York Department of Health has proposed 10 ppt for PFOS and 10 ppt for PFOA. The proposal considered the fact that people already have exposure to these substances from other sources.

Recommendations

Recommendations for Stockholm Convention COP9

1. PFOA should be listed in Annex A with no specific exemptions. If exemptions are granted, they should be for specific products and the listing should require labeling new products that contain PFOA so that Parties can fulfill requirements under Article 6 as done previously for HBCD (SC-6/13).

2. Due to the costly, highly polluting nature of firefighting foams, and the availability of cost-effective, technically feasible non-fluorinated alternatives, no specific exemptions should be adopted either for PFOS or PFOA production and/or use in firefighting foams.

3. Specific exemptions or acceptable purposes for the following 11 uses of PFOS should be ended: photo-imaging, photo-resist and anti-reflective coatings for semiconductors; etching agent for compound semiconductors and ceramic filters; aviation hydraulic fluid; certain medical devices; photo masks in semiconductor and LCD industries; hard metal plating; decorative metal plating; electric and electronic parts for some color printers and color copy machines; insecticides for control of red imported fire ants and termites; and chemically-driven oil production.

4. The following 3 acceptable purposes should be converted into specific exemptions: metal plating (hard metal plating only in closed loop systems); firefighting foams; insect bait for control of leaf-cutting ants from *Atta* spp. and *Acromyrmex* spp. Sulfluramid should be named in the PFOS listing and its use sharply limited to cultivation of specific crops.

National Recommendations - Malaysia

1. Expedite the ratification of the Stockholm Convention on POPs.

2. Enact specific regulations to prohibit PFAS production, use, import, and export. To avoid costly mistakes, PFAS should be banned as a class.

3. Create awareness among workers and the general population regarding dangers of PFAS.

4. Personnel involved in enforcing regulations for example the Customs Department and Port authorities should be able to identify prohibited chemicals such as PFAS.

5. Identify industries that are using PFAS and hotspots. PFAS monitoring should be conducted at hotspots near industrial areas.

6. To prevent PFAS pollution and subsequent costly remediation, Malaysia should make an inventory on firefighting foam stocks promptly and replace PFAS-containing foams with fluorine-free foams as early as possible.

7. Conduct training for emergency personnel (firefighters, medical service personnel, law enforcement officers, hazmat personnel) who could be exposed during handling accidents and spills involving PFAS.

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Annex 1. PFAS toxicity

The Stockholm Convention expert committee (please see Annex 3) evaluated the toxicity characteristics of PFOS in 2007 and PFOA in 2017. Since then, more scientific information has emerged for both these substances along with some of the shorter-chain PFAS aggressively promoted by the industry as substitutes.

Recent research shows the harmful impacts of PFAS

Recent studies have linked PFAS substances to a variety of human health effects: cardiovascular disease, markers of asthma, damage to semen quality, ovarian insufficiency, altered glucose metabolism, lower testosterone levels in male adolescents, association with shorter birth length in girls, elevated blood pressure, abnormal menstruation, lower birth weight in infants, possible increased risk of female infertility due to endometriosis, and decreased lung function in children with asthma.

The chemical industry promoted perfluorohexane sulfonate (PFHxS) as a substitute for PFOS. In 2018, the Stockholm Convention expert committee concluded that it "warrants global action." PFHXS is found in 2 – 4 month-old infants and associated with damage to semen quality. The Stockholm Convention expert committee found that PFHxS has been detected in human blood and breast milk in many regions, and is together with perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA) and perfluorononanoic acid (PFNA) one of the most frequently detected and predominant PFASs in human blood. The Committee noted that the fetus is exposed to PFHxS via umbilical cord blood and that animal studies show impacts on reproduction, liver function, thyroid hormone levels, and lipid and lipoprotein metabolism.

Studies showing the toxicity, environmental fate, and occurrence of PFAS in current use include:

Perfluorobutanoic acid (PFBA)

- Effects on thyroid and developmental delays in offspring exposed during pregnancy
- Similar toxicity to liver as PFOA
- Associated with damage to semen quality
- Found in home-produced eggs
- Found in the Arctic
- Efficiently translocated into plants
- Taken up by corn
- Found in fruits and vegetables
- Contaminates fish
- Found in humans in a community with known drinking water contamination
- Found in consumer products

Perfluorobutane sulfonate (PFBS)

- Associated with damage to semen quality
- Disrupts pancreas formation in zebrafish

- Associated with cardiovascular disease in humans
- Associated with markers of asthma in humans
- Increases fatty tissue formation in laboratory studies
- Impairs visual function in fish
- Damages thyroid function in fish in subsequent generations
- Induces reproductive toxicity in animal studies
- Found in 2 – 4 month-old infants
- Found in humans in community with known drinking water contamination
- Found in children
- Found in the Arctic
- Found in consumer products

Perfluorohexanoic acid (PFHxA)

- Similar toxicity to liver as PFOA
- Associated with damage to semen quality
- Negatively associated with testosterone levels in adolescent humans
- Alters zebrafish behavior
- Modulates immune response in vitro
- Contaminated drinking water linked to human body burden
- Alters amphibian embryogenesis
- Exposes the human fetus vis presence in amniotic fluid
- Found in human milk
- Found in house dust
- Found in US wildlife preserves
- Found in the Arctic
- Contaminates fish
- Found in Indo-Pacific humpback dolphins and finless porpoises
- Efficiently translocated into plants
- Resistant to sewage treatment
- Found in US wastewater treatment plants

Perfluoroheptanoic acid (PFHpA)

- Alters amphibian embryogenesis
- Exposes the human fetus via presence in amniotic fluid
- Found in human milk
- Manufacturing sites, military fire training, and wastewater treatment plants are predictors of pollution
- Use in airport firefighting foams pollutes groundwater, lakes, soils, and fish
- Found in remote mountain snow
- Bioaccumulates in plankton
- Contaminates fish
- Efficiently translocated into plants

PFAS in people

Numerous studies show PFAS contamination in people. For example, in one study of 299 infants, PFOS was found in the blood of 297 of them and PFOA was found in all of them.

The Stockholm Convention conducts global monitoring of substances listed in the treaty as part of its effectiveness evaluation. The most recent data is from a series of regional monitoring reports published in 2015.

In Africa, the treaty monitoring study noted that PFOS was detected in mothers' milk from all 11 countries that submitted samples with levels varying from 1 – 34 ppt. The report notes that, *"Assuming that there is no industrial production of PFOS in the region, exposure of humans to PFOS and related chemicals might probably come from different kinds of waste, releases from industrial applications in firefighting and the various consumer products."*

The monitoring report for the Asia-Pacific region notes that only a few countries reported data. The report shows PFOS in air in Fiji, Hong Kong, Japan and in blood including maternal plasma in Japan. PFOS was also measured in marine areas in China, Hong Kong, Japan, Macao and rivers and lakes in Philippines, South Korea, and Thailand.

In Central and Eastern Europe, the Stockholm Convention monitoring report notes that data on water monitoring are scarce and data for the presence of PFOS in human tissues is even more limited.

Stockholm Convention monitoring in Latin America and the Caribbean showed that only Uruguay reported data on PFOS in air and the report notes that at this time (2015) there was no formal monitoring program in the region for determination of PFOS.

In Western Europe and Other States, monitoring data also includes the Arctic where PFOS and PFOA in air were measured. The report notes that phaseouts of PFOS and PFOA are reflected in declining concentrations but that fluorinated substitutes show increasing levels in Arctic air. The study also reveals that of all the measured POPs, PFOS was the predominant substance in human plasma, with the highest level of 470 ppt reported in an Inuit resident of the Arctic.

Recent scientific studies show the widespread presence PFAS in humans. Data include the following:

- Perfluorohexane sulfonate (PFHxS), perfluorononanoate (PFNA), perfluorodecanoate (PFDA), perfluoroundecanoate (PFUnDA), and perfluorotridecanoate (PFTrDA) in human milk in Sweden
- PFOS, PFOA, PFNA, PFDA, PFUnA and PFHxS in maternal sera, placentas, and fetuses.
- PFOS, PFOA, PFHxS, and PFNA in New Zealand adults
- PFOS, PFDoDA, PFUnDA and PFTrDA in pregnant Japanese women

- PFOS, PFOA, PFHxS in >94% of community residents with drinking water contaminated by a former US Air Force base.
- 10 long-chain PFAS in California women.
- PFOS< PFOA< PFHxS, PFNA, PFUnDA, PFHpS found in maternal plasma in Norway.
- PFAS in amniotic fluid in Denmark.
- Prenatal exposure to PFOS, PFHxS, PFHpS, PFNA, and PDFA in Denmark.
- Prenatal exposure to PFBS, PFHxS, PFUA in China.
- Six PFAS in middle-aged US women.
- PFNA, PFDA, PFUnDA, PFHxS, PFOA, and PFOS in more than 99% of sampled pregnant Swedish women.
- PFAS in maternal and cord blood in mothers exposed to the US World Trade Center disaster during pregnancy.
- PFOA, PFOS, PFNA, PFHxS in cord blood of Slovak infants.
- PFOS, PFOS and 6:2 CL-PFESA in cerebrospinal fluid in China indicating ability to cross the blood-CSF barrier.
- PFOS, PFOA, PFNA, and PFHxS in children.
- PFOA, PFOS< PFNA, and PFHxS in pregnant US women.
- PFOS< PFOA< PFHxS and PFNA in maternal serum in the UK.
- PFOA, PFOS, and PFHxS in Chinese women.
- PFOA and PFNA in US children.
- PFAS in Alaska Natives.
- PFHxS, PFOA< PFOA, PFNA, PFDA, PFUdA, PFDoA, and PFTrDA in >85% of sampled pregnant women in China.
- PFAS in pregnant Chinese women.

Manufacturers knew PFAS were harmful

Recently obtained documents indicate that the original manufacturers of PFOS and PFOA knew about the harmful characteristics of both substances decades ago.

A lawsuit filed by the US State of Minnesota against 3M produced internal company documents that demonstrated that the company knew PFOS and PFOA were accumulating in people for more than 40 years. 3M had previously withheld required documents from US regulators which resulted in a USD$1.5 million fine in 2006. In 1975, university researchers found a fluorinated substance in human blood and 3M confirmed that it was PFOS. Subsequent company testing found PFOS levels in 3M personnel at levels 50 – 1000 times higher than normal levels. In 1978, tests on monkeys feed PFOS resulted in all the animals dying and those given PFOA developed lesions on their spleen, lymph nodes, and bone marrow, all relevant to a functioning immune system. By 1989, the company knew that PFOS suppressed the immune system, caused tumors in animals, and that rates of cancers of the digestive organs and prostate were elevated in its own workers. The company proceeded to produce the substance anyway.

Internal company documents reveal that DuPont knew decades ago that PFOA affected the livers of dogs and humans, encouraged the growth of testicular tumors in rats, and appeared to result in endocrine disorders and kidney cancer in workers. In 1978, the company documented immunotoxicity and other adverse effects in tests on monkeys exposed to PFOA and PFOS. By 1984, DuPont knew that PFOA was toxic, didn't break down, accumulated in blood, transferred from mothers to the fetus, and polluted drinking water supplies. DuPont decided to keep producing it anyway as it became incorporated into a multitude of products and processes. The company's real attitude about the consequences of PFOA production is revealed in its internal documents as "the material 3M sells us that we poop to the river and into drinking water."

DuPont was fully aware of PFOA's hazards, but a study of the company's decision-making processes noted that DuPont made a calculated, rational decision to pollute anyway. The authors estimate that for DuPont, "it was value-maximizing to pollute if the probability of getting caught was less than 19%." In reality the probability was much less than that and now communities and governments bear the burden of that private sector decision.

Annex 2. The high cost of PFAS cleanup

PFAS manufacturing and use in a multitude of products such as firefighting foams has resulted in widespread pollution – especially in water due to the solubility of PFAS substances. PFAS-contaminated sites have been identified in Australia, Canada, China, Germany, Italy, Japan, Netherlands, New Zealand, South Korea, Sweden, and the US, including a large number of military bases that contribute to 172 PFAS contamination sites in 40 states. In 2018, the US State of Minnesota entered into an agreement with 3M for the company to pay the state USD$850 million for costs associated with cleanup of PFAS including PFHxS due to manufacturing and releases by the company.

Clean up of PFAS pollution is difficult and costly. According to the Polluter Pays Principle, and sound economic policy, these types of external costs should not be borne by taxpayers, the state or national treasury, or by any other third party. Rather, these costs should be internalized within producer industries to avoid market distortion. As noted by UN Environment in 2012, "The vast majority of human health costs linked to chemicals production, consumption and disposal are not borne by chemicals producers, or shared down the value-chain. Uncompensated harms to human health and the environment are market failures that need correction."

Examples of estimated and actual cleanup costs for PFAS pollution include:

- Recent US government agency estimates for the cost PFAS clean-ups and associated monitoring due to use of firefighting foams at US military bases are more than USD$2 billion. There are also expensive clean up costs and estimates in a variety of US states including Alaska, New Jersey, New York (see also here and here), Vermont, Virginia, and Washington.
- The World Bank estimates that if just 20% of fluorinated firefighting foam in China is used for training or fire extinguishing, remediation costs would exceed USD$800 million.
- Remediation of PFAS-containing firefighting foam at the Düsseldorf Airport in Germany will take years or even decades. Cleanup costs cited by the European Chemicals Agency exceed €100 million. There are additional documented remediation costs due to PFAS pollution in Germany – see here, here, and here.
- Clean up due to use of 3M's "Light Water" firefighting foam containing PFOS and PFHxS at 18 military bases in Australia is estimated to cost hundreds of millions of dollars. The cleanup of just a single firefighting training college in Australia is estimated to cost AUS$80 million.
- To clean up groundwater polluted by PFAS around firefighting areas in Norway costs €3.5-5.5 million per training site.
- Firefighting training sites are the main sources of PFAS pollution in Sweden leading to €1 million in annual costs for charcoal filtering of water in Uppsala and a new water supply in Ronne costing €3 million. Extrapolated estimates for advanced cleaning of all waste water treatment plants in Sweden would only moderately remove fluorinated compounds but still cost USD$230 million per year.
- New Zealand has budgeted NZE$1 million to investigate cleanup of PFAS associated with firefighting foam use by military bases.

Annex 3. PFAS and the Stockholm Convention

The Stockholm Convention objective is to protect human health and the environment from persistent organic pollutants. Persistent organic pollutants (POPs) are a class of highly hazardous chemical pollutants that are recognized as a serious, global threat to human health and to ecosystems. Substances can be added to the Stockholm Convention after evaluation and recommendation by the POPs Review Committee (POPRC). Malaysia signed the treaty in 2002 but has yet to ratify the Convention.

PFOS

Governments added PFOS to the treaty list at the 4th Conference of the Parties in 2009 and subsequently adopted a series of guidance documents on PFOS alternatives.

When PFOS was listed in Annex B of the treaty in 2009, a very large number of loopholes accompanied its listing that permitted continued production and use. At COP9 in April/May 2019, Parties will determine if these loopholes are still needed or if some can be ended. The decision will focus on 6 time-limited ones (specific exemptions) and 8 time-unlimited ones (known as acceptable purposes). The POPRC recommended the following changes to the PFOS listing in the Convention:

End loopholes for 11 PFOS uses: photo-imaging, photo-resist and anti-reflective coatings for semiconductors; etching agent for compound semiconductors and ceramic filters; aviation hydraulic fluid; certain medical devices; photo masks in semiconductor and LCD industries; hard metal plating; decorative metal plating; electric and electronic parts for some color printers and color copy machines; insecticides for control of red imported fire ants and termites; and chemically-driven oil production.

Convert two time-unlimited exemptions to time-limited exemptions: metal plating (hard metal plating only in closed loop systems) and firefighting foams. This gets the clock running on ending these uses in five years. On the firefighting foams, the Committee recommended stopping production and only allowing use for class B fires (ones involving solvents, oil etc.) and only in installed systems. The Committee also noted that, *"a transition to the use of short-chain per- and polyfluoroalkyl substances (PFASs) for dispersive applications such as fire-fighting foams is not a suitable option from an environmental and human health point of view…"* This is extremely important since the fluorinated alternatives are persistent, toxic and readily pollute drinking water.

Continue time-unlimited exemption for one use: insect bait for control of leaf-cutting ants from *Atta* spp. and *Acromyrmex* spp. This vaguely-worded listing actually refers to a pesticide called sulfluramid that degrades to PFOS. The POPRC recommended naming sulfluramid in the treaty under the PFOS listing and narrowing its use to agriculture.

IPEN recommendations for PFOS

Specific exemptions or acceptable purposes for the following 12 uses of PFOS should be ended: photo-imaging, photo-resist and anti-reflective coatings for semiconductors; etching agent for compound semiconductors and ceramic filters; aviation hydraulic fluid; certain medical devices; firefighting foams, photo masks in semiconductor and LCD industries; hard metal plating; decorative metal plating; electric and electronic parts for some color printers and color copy machines; insecticides for control of red imported fire ants and termites; and chemically-driven oil production. If a specific exemption is allowed for use in firefighting foams, the POPRC recommendations should be adopted.

The following 2 acceptable purposes should be converted into specific exemptions: metal plating (hard metal plating only in closed loop systems); and insect bait for control of leaf-cutting ants from *Atta* spp. and *Acromyrmex* spp. Sulfluramid should be named in the PFOS listing and its use sharply limited to cultivation of specific crops.

PFOA

PFOA is extremely persistent and does not degrade under relevant environmental conditions. It bioaccumulates in air-breathing land and marine mammals, including humans. PFOA is found in water, snow, air, sediment and biota at remote locations including the Arctic. In 2017, the Stockholm Convention POPs Review Committee noted the link between PFOA and serious illnesses in humans, including diagnosed high cholesterol, ulcerative colitis, thyroid disease, testicular cancer, kidney cancer and pregnancy-induced hypertension. PFOA is transferred to the fetus through the placenta and to infants via breast milk. PFOA-related compounds such as fluorotelomer alcohols, fluoropolymers and fluorotelomer-based polymers must be included in actions designed to eliminate PFOA releases since they can degrade to PFOA.

In 2018, the POPRC recommended that governments list PFOA and related substances in Annex A of the Stockholm Convention for global elimination.

Ten time-limited exemptions accompany the PFOA listing recommendation, however, many of these are not justified.

Proposed PFOA Exemption	**Comment**
5 years 3 exemptions connected to semiconductor manufacturing (equipment or plant infrastructure, legacy equipment, photo-lithography, etch process)	Alternatives without PFOS or PFOA are available for photolithography and etch processes. For example, IBM eliminated both in 2010. The other proposals are not sufficiently defined.
Photographic coatings applied to films	Obsolete use of PFOA replaced by digital imaging, including in developing and transition countries.

Textiles for oil and water repellency for workers	Proposal relies on industry claims and does not state what specific products the exemption would cover or how worker protection can be achieved without relying on a toxic chemical-impregnated textile.
Invasive medical devices	Alternative medical devices made without PFOA have passed all regulatory requirements, are available on the market, and in use.
Implantable medical devices	Alternative medical devices made without PFOA have passed all regulatory requirements, are available on the market, and in use.
Firefighting foams	Cost-effective non-fluorinated alternatives are in use at major airports and military installations and perform as well as PFAS-containing foams.
10 years For manufacture of semiconductor or related electronic devices; refurbishment parts containing fluoropolymers and/or fluoroelastomers with PFOA for legacy equipment or legacy refurbishment parts	See above for manufacturing. Legacy equipment proposal is not specific and include thousands of unnamed parts. Retrofitting with parts that do not contain PFOA should be utilized, instead of continuing PFOA production and use.
Until 2036 To use PFOI (a PFOA-related substance) to make PFOB for producing pharmaceutical products *"with a review of continued need for exemptions."*	In 2015, more than 100 governments agreed that environmentally persistent pharmaceutical products are an emerging policy issue of global concern in the SAICM process. A global exemption should not be adopted on behalf of a single company (Daikin) and exemptions for environmentally persistent pharmaceutical products should not be recommended.

IPEN recommendations for PFOA

PFOA should be listed in Annex A with no specific exemptions. If exemptions are granted, they should be for specific products and the listing should require labeling new products that contain PFOA so that Parties can fulfill requirements under Article 6 as done previously for HBCD (SC-6/13). In addition, due to the costly, highly polluting nature of firefighting foams, and the availability of technically feasible, high-performing non-fluorinated alternatives, no exemption should be granted for this use.

PFHxS

PFHxS and related compounds are persistent in water, soil and sediment and unlikely to undergo degradation in the environment including hydrolysis, aqueous photolysis or under anaerobic conditions. PFHxS biomagnification factors (BMF) greater than 1 have been observed in food chains including Arctic bird/fish, Arctic polar bear/ringed seal, dolphin/fish, and fish/zoo plankton among others, indicating bioaccumulation. PFHxS has the longest half-life in humans determined for any PFAS. PFHxS undergoes long-range transport and is found in Arctic air, sediment, snow, ice, soil, sediment and biota (including humans) and in Antarctic biota and snow. *In vivo* and epidemiological studies show that PFHxS negatively affects liver function, thyroid, and the developing immune system resulting in reduced effects of vaccines and higher incidences of infections and asthma in children. A significant association between PFHxS exposure and breast cancer has been found in Greenlandic Inuit women. PFHxS is widely found in breast milk and is one of the most frequently detected and predominant PFAS in human blood, including maternal and infant cord blood. In September 2018, the POPRC determined that PFHxS "warrants global action" and moved the substance to the third and final evaluation during 2018 – 2019.

PFAS use in firefighting foams

There are many uses of PFAS, but one of the most highly polluting is in firefighting foams. This pollution occurs where the foam is used and quickly contaminates water and moves. Airports and military bases are common sources of PFAS pollution.

PFOS and PFOA were the original components in firefighting foams, but after regulatory pressure in the US, many companies switched to shorter-chain substances such as PFHxS, PFBA, PFBS, PFHxA, and PFHpA. These substances also are persistent and have hazardous properties. Some are found in the Arctic, suggesting ability to undergo long-range transport. Recently, IPEN assembled a group of fire safety experts who produced a detailed report on issues involving firefighting foams and the technical feasibility of fluorine-free firefighting foams. Safer cost competitive non-fluorinated alternatives to PFAS in firefighting foams have been adopted by major airports, including Auckland, Copenhagen, Dubai, Dortmund, Stuttgart, London Heathrow, Manchester, and all 27 major airports in Australia.

In September 2018, the POPRC recommended severe restrictions on the use of PFOS and PFOA in firefighting foams. In addition, the Committee also made an extremely important recommendation **not** to use the fluorinated alternatives to PFOA and PFOS, *"due to their persistency and mobility as well as potential negative environmental, health and socioeconomic impacts."*

The recommended restrictions on firefighting foams containing PFOA, PFOA-related substances, or PFOS include:

- No production.
- Use for 5 years only for liquid fuel vapor suppression and liquid fuel fires (Class B fires) already in installed systems.
- No import or export, except for environmentally-sound disposal.
- No use for training or testing purposes.
- By 2022, restrict use to sites where all releases can be contained.
- Ensure that all firewater, wastewater, run-off, foam and other wastes are managed in accordance with the treaty.

IPEN recommendations on PFAS use firefighting foams

Due to the costly, highly polluting nature of firefighting foams, and the availability of technically feasible, high-performing alternatives, no exemption should be granted for this use. IPEN supports the POPRC recommendation that fluorinated alternatives to PFOA and PFOS should not be used.