

## The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)

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As scientists and other professionals from a variety of disciplines, we are concerned about the production and release into the environment of an increasing number of poly- and perfluoroalkyl substances (PFASs) for the following reasons:

1. PFASs are man-made and found everywhere. PFASs are highly persistent, as they contain perfluorinated chains that only degrade very slowly, if at all, under environmental conditions. It is documented that some polyfluorinated chemicals break down to form perfluorinated ones (D'Eon and Mabury 2007).
2. PFASs are found in the indoor and outdoor environments, wildlife, and human tissue and bodily fluids all over the globe. They are emitted via industrial processes and military and firefighting operations (Darwin 2011; Fire Fighting Foam Coalition 2014), and they migrate out of consumer products into air (Shoeb et al. 2011), household dust (Björklund et al. 2009), food (Begley et al. 2008; Tittlemier et al. 2007; Trier et al. 2011), soil (Sepulvado et al. 2011; Strynar et al. 2012), ground and surface water, and make their way into drinking water (Eschazuer et al. 2012; Rahman et al. 2014).
3. In animal studies, some long-chain PFASs have been found to cause liver toxicity, disruption of lipid metabolism and the immune and endocrine systems, adverse neurobehavioral effects, neonatal toxicity and death, and tumors in multiple organ systems (Lau et al. 2007; Post et al. 2012). In the growing body of epidemiological evidence, some of these effects are supported by significant or suggestive associations between specific long-chain PFASs and adverse outcomes, including associations with testicular and kidney cancers (Barry et al. 2013; Benbrahim-Tallaa et al. 2014), liver malfunction (Gallo et al. 2012), hypothyroidism (Lopez-Espinosa et al. 2012), high cholesterol (Fitz-Simon et al. 2013; Nelson et al. 2009), ulcerative colitis (Steenland et al. 2013), lower birth weight and size (Fei et al. 2007), obesity (Halldorsson et al. 2012), decreased immune response to vaccines (Grandjean et al. 2012), and reduced hormone levels and delayed puberty (Lopez-Espinosa et al. 2011).
4. Due to their high persistence, global distribution, bioaccumulation potential, and toxicity, some PFASs have been listed under the Stockholm Convention (United Nations Environment Programme 2009) as persistent organic pollutants (POPs).
5. As documented in the Helsingør Statement (Scheringer et al. 2014),
  - a. Although some of the long-chain PFASs are being regulated or phased out, the most common replacements are short-chain PFASs with similar structures, or compounds with fluorinated segments joined by ether linkages.
  - b. While some shorter-chain fluorinated alternatives seem to be less bioaccumulative, they are still as environmentally persistent as long-chain substances or have persistent degradation products. Thus, a switch to short-chain and other fluorinated alternatives may not reduce the amounts of PFASs in the environment. In addition, because some of the shorter-chain PFASs are less effective, larger quantities may be needed to provide the same performance.
  - c. While many fluorinated alternatives are being marketed, little information is publicly available on their chemical structures, properties, uses, and toxicological profiles.

- d. Increasing use of fluorinated alternatives will lead to increasing levels of stable perfluorinated degradation products in the environment, and possibly also in biota and humans. This would increase the risks of adverse effects on human health and the environment.

6. Initial efforts to estimate overall emissions of PFASs into the environment have been limited due to uncertainties related to product formulations, quantities of production, production locations, efficiency of emission controls, and long-term trends in production history (Wang et al. 2014).
7. The technical capacity to destroy PFASs is currently insufficient in many parts of the world.

Global action through the Montreal Protocol (United Nations Environment Programme 2012) successfully reduced the use of the highly persistent ozone-depleting chlorofluorocarbons (CFCs), thus allowing for the recovery of the ozone layer. However, many of the organofluorine replacements for CFCs are still of concern due to their high global warming potential. It is essential to learn from such past efforts and take measures at the international level to reduce the use of PFASs in products and prevent their replacement with fluorinated alternatives in order to avoid long-term harm to human health and the environment.

For these reasons, we call on the international community to cooperate in limiting the production and use of PFASs and in developing safer nonfluorinated alternatives. We therefore urge scientists, governments, chemical and product manufacturers, purchasing organizations, retailers, and consumers to take the following actions:

### Scientists:

1. Assemble, in collaboration with industry and governments, a global inventory of all PFASs in use or in the environment, including precursors and degradation products, and their functionality, properties, and toxicology.
2. Develop analytical methods for the identification and quantification of additional families of PFASs, including fluorinated alternatives.
3. Continue monitoring for legacy PFASs in different matrices and for environmental reservoirs of PFASs.
4. Continue investigating the mechanisms of toxicity and exposure (e.g., sources, fate, transport, and bioaccumulation of PFASs), and improve methods for testing the safety of alternatives.
5. Bring research results to the attention of policy makers, industry, the media, and the public.

### Governments:

1. Enact legislation to require only essential uses of PFASs, and enforce labeling to indicate uses.
2. Require manufacturers of PFASs to
  - a. conduct more extensive toxicological testing,
  - b. make chemical structures public,
  - c. provide validated analytical methods for detection of PFASs, and
  - d. assume extended producer responsibility and implement safe disposal of products and stockpiles containing PFASs.
3. Work with industry to develop public registries of products containing PFASs.
4. Make public annual statistical data on production, imports, and exports of PFASs.

- Whenever possible, avoid products containing, or manufactured using, PFASs in government procurement.
- In collaboration with industry, ensure that an infrastructure is in place to safely transport, dispose of, and destroy PFASs and PFAS-containing products, and enforce these measures.

#### Chemical manufacturers:

- Make data on PFASs publicly available, including chemical structures, properties, and toxicology.
- Provide scientists with standard samples of PFASs, including precursors and degradation products, to enable environmental monitoring of PFASs.
- Work with scientists and governments to develop safe disposal methods for PFASs.
- Provide the supply chain with documentation on PFAS content and safe disposal guidelines.
- Develop nonfluorinated alternatives that are neither persistent nor toxic.

#### Product manufacturers:

- Stop using PFASs where they are not essential or when safer alternatives exist.
- Develop inexpensive and sensitive PFAS quantification methods for compliance testing.
- Label products containing PFASs, including chemical identity and safe disposal guidelines.
- Invest in the development and use of nonfluorinated alternatives.

#### Purchasing organizations, retailers, and individual consumers:

- Whenever possible, avoid products containing, or manufactured using, PFASs. These include many products that are stain-resistant, waterproof, or nonstick.
- Question the use of such fluorinated "performance" chemicals added to consumer products.

*The views expressed in this statement are solely those of the authors and signatories. The authors declare they have no actual or potential competing financial interests.*

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#### REFERENCES

Barry V, Winquist A, Steenland K. 2013. Perfluorooctanoic acid (PFOA) exposures and incident cancers among adults living near a chemical plant. *Environ Health Perspect* 121(11–12):1313–1318; doi:10.1289/ehp.1306615.

Begley TH, Hsu W, Noonan G, Diachenko G. 2008. Migration of fluorochemical-paper additives from food-contact paper into foods and food simulants. *Food Addit Contam Part A Chem Anal Control Expo Risk Assess* 25(3):384–390; doi:10.1080/02652030701513784.

Benbrahim-Tallaa L, Lauby-Secretan B, Loomis D, Guyton KZ, Grosse Y, El Ghissassi F, et al. 2014. Carcinogenicity of perfluorooctanoic acid, tetrafluoroethylene, dichloromethane, 1,2-dichloropropane, and 1,3-propane sultone. *Lancet Oncol* 15(9):924–925; doi:10.1016/S1470-2045(14)70316-X.

Björklund JA, Thuresson K, de Wit CA. 2009. Perfluoroalkyl compounds (PFCs) in indoor dust: concentrations, human exposure estimates, and sources. *Environ Sci Technol* 43(7):2276–2281; doi:10.1021/es803201a.

Darwin RL. 2011. Estimated Inventory of PFOS-Based Aqueous Film Forming Foam (AFFF). Arlington, VA:Fire Fighting Foam Coalition.

D'Eon JC, Mabury SA. 2007. Production of perfluorinated carboxylic acids (PFCA) from the biotransformation of polyfluoroalkyl phosphate surfactants (PAPS): exploring routes of human contamination. *Environ Sci Technol* 41(13):4799–4805; doi:10.1021/es070126x.

Eschauer C, Beerendonk E, Scholte-Veenendaal P, De Voogt P. 2012. Impact of treatment processes on the removal of perfluoroalkyl acids from the drinking water production chain. *Environ Sci Technol* 46(3):1708–1715; doi:10.1021/es201662b.

Fei C, McLaughlin JK, Tarone RE, Olsen J. 2007. Perfluorinated chemicals and fetal growth: a study within the Danish National Birth Cohort. *Environ Health Perspect* 115(11):1677–1682; doi:10.1289/ehp.10506.

Fire Fighting Foam Coalition. 2014. Fact Sheet on AFFF Fire Fighting Agents. Arlington, VA:Fire Fighting Foam Coalition. Available: <http://www.fffco.org/images/AFFFfactsheet14.pdf> [accessed 6 April 2015].

Fitz-Simon N, Fletcher T, Luster MI, Steenland K, Calafat AM, Kato K, et al. 2013. Reductions in serum lipids with a 4-year decline in serum perfluorooctanoic acid and perfluorooctanesulfonic acid. *Epidemiology* 24(4):569–576; doi:10.1097/EDE.0b013e31829443ee.

Gallo V, Leonardi G, Genser B, Lopez-Espinosa MJ, Frisbee SJ, Karlsson L, et al. 2012. Serum perfluorooctanoate (PFOA) and perfluorooctane sulfonate (PFOS) concentrations and liver function biomarkers in a population with elevated PFOA exposure. *Environ Health Perspect* 120(5):655–660; doi:10.1289/ehp.1104436.

Grandjean P, Andersen EW, Budtz-Jørgensen E, Nielsen F, Mølbak K, Weihe P, et al. 2012. Serum vaccine antibody concentrations in children exposed to perfluorinated compounds. *JAMA* 307(4):391–397; doi:10.1001/jama.2011.2034.

Halldórsson TI, Rytter D, Haug LS, Bech BH, Danielsen I, Becher G, et al. 2012. Prenatal exposure to perfluorooctanoate and risk of overweight at 20 years of age: a prospective cohort study. *Environ Health Perspect* 120(5):668–673; doi:10.1289/ehp.1104034.

Lau C, Anitole K, Hodes C, Lai D, Pfahles-Hutchens A, Seed J. 2007. Perfluoroalkyl acids: a review of monitoring and toxicological findings. *Toxicol Sci* 99(2):366–394; doi:10.1093/toxsci/kfm128.

Lopez-Espinosa M, Fletcher T, Armstrong B, Genser B, Dhatriya K, Mondal D, et al. 2011. Association of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) with age of puberty among children living near a chemical plant. *Environ Sci Technol* 45(19):8160–8166; doi:10.1021/es1038694.

Lopez-Espinosa MJ, Mondal D, Armstrong B, Bloom MS, Fletcher T. 2012. Thyroid function and perfluoroalkyl acids in children living near a chemical plant. *Environ Health Perspect* 120(7):1036–1041; doi:10.1289/ehp.1104370.

Nelson JW, Hatch EE, Webster TF. 2010. Exposure to polyfluoroalkyl chemicals and cholesterol, body weight, and insulin resistance in the general U.S. population. *Environ Health Perspect* 118(2):197–202; doi:10.1289/ehp.0901165.

Post GB, Cohn PD, Cooper KR. 2012. Perfluorooctanoic acid (PFOA), an emerging drinking water contaminant: a critical review of recent literature. *Environ Res* 116:93–117; doi:10.1016/j.envres.2012.03.007.

Rahman MF, Peldszus S, Anderson WB. 2014. Behaviour and fate of perfluoroalkyl and polyfluoroalkyl substances (PFASs) in drinking water treatment: a review. *Water Res* 50:318–340; doi:10.1016/j.watres.2013.10.045.

Scheringer M, Trier X, Cousins IT, de Voogt P, Fletcher T, Wang Z, et al. 2014. Helsingør Statement on poly- and perfluorinated alkyl substances (PFASs). *Chemosphere* 114:337–339; doi:10.1016/j.chemosphere.2014.05.044.

Sepulveda JG, Blaine AC, Hundal LS, Higgins CP. 2011. Occurrence and fate of perfluorochemicals in soil following the land application of municipal biosolids. *Environ Sci Technol* 45(19):8106–8112; doi:10.1021/es103903d.

Shoeb M, Harner T, Webster GM, Lee SC. 2011. Indoor sources of poly- and perfluorinated compounds (PFCS) in Vancouver, Canada: implications for human exposure. *Environ Sci Technol* 45(19):7999–8005; doi:10.1021/es103562v.

Steenland K, Zhao L, Winquist A, Parks C. 2013. Ulcerative colitis and perfluorooctanoic acid (PFOA) in a highly exposed population of community residents and workers in the Mid-Ohio Valley. *Environ Health Perspect* 121(8):900–905; doi:10.1289/ehp.1206449.

Strynar MJ, Lindstrom AB, Nakayama SF, Egeghy PP, Helfant LJ. 2012. Pilot scale application of a method for the analysis of perfluorinated compounds in surface soils. *Chemosphere* 86(3):252–257; doi:10.1016/j.chemosphere.2011.09.036.

Tittlemier SA, Pepper K, Seymour C, Moisey J, Bronson R, Cao XL, et al. 2007. Dietary exposure of Canadians to perfluorinated carboxylates and perfluorooctane sulfonate via consumption of meat, fish, fast foods, and food items prepared in their packaging. *J Agric Food Chem* 55(8):3203–3210; doi:10.1021/jf0634045.

Trier X, Granby K, Christensen JH. 2011. Polyfluorinated surfactants (PFS) in paper and board coatings for food packaging. *Environ Sci Pollut Res Int* 18(7):1108–1120; doi:10.1007/s11356-010-0439-3.

United Nations Environment Programme. 2009. The New POPs under the Stockholm Convention. Châtelaine, Switzerland:Stockholm Convention, United Nations Environment Programme. Available: <http://chm.pops.int/Implementation/NewPOPs/TheNewPOPs/tabid/672/Default.aspx> [accessed 6 April 2015].

United Nations Environment Programme. 2012. The Montreal Protocol on Substances that Deplete the Ozone Layer. Nairobi, Kenya:Montreal Protocol, United Nations Environment Programme. Available: [http://ozone.unep.org/new\\_site/en/Treaties/treaties\\_decisions-hb.php?sec\\_id=5](http://ozone.unep.org/new_site/en/Treaties/treaties_decisions-hb.php?sec_id=5) [accessed 6 April 2015].

Wang Z, Cousins IT, Scheringer M, Buck RC, Hungerbühler K. 2014. Global emission inventories for C4–C14 perfluoroalkyl carboxylic acid (PFCA) homologues from 1951 to 2030, part II: the remaining pieces of the puzzle. *Environ Int* 69:166–176; doi:10.1016/j.envint.2014.04.006.

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## The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)

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