

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

<http://dx.doi.org/10.1289/ehp.1509934>

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.

Arlene Blum,^{1,2} Simona A. Balan,² Martin Scheringer,^{3,4} Xenia Trier,⁵ Gretta Goldenman,⁶ Ian T. Cousins,⁷ Miriam Diamond,⁸ Tony Fletcher,⁹ Christopher Higgins,¹⁰ Avery E. Lindeman,² Graham Peaslee,¹¹ Pim de Voogt,¹² Zhanyun Wang,⁴ and Roland Weber¹³

¹Department of Chemistry, University of California at Berkeley, Berkeley, California, USA; ²Green Science Policy Institute, Berkeley, California, USA; ³Leuphana University, Lüneburg, Germany; ⁴Safety and Environmental Technology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland; ⁵Division of Food Chemistry, National Food Institute, Technical University of Denmark, Kongens Lyngby, Denmark; ⁶European Centre on Sustainable Policies for Human and Environmental Rights, Brussels, Belgium; ⁷Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden; ⁸Department of Earth Sciences, University of Toronto, Toronto, Ontario, Canada; ⁹Department of Social and Environmental Health Research, London School of Hygiene & Tropical Medicine, London, United Kingdom; ¹⁰Department of Civil and Environmental Engineering, Colorado School of Mines, Golden, Colorado, USA; ¹¹Chemistry Department, Hope College, Holland, Michigan, USA; ¹²Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, the Netherlands; ¹³POPs Environmental Consulting, Schwäbisch Gmünd, Germany
E-mail: arlene@greensciencepolicy.org

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, Dhataria 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/es103869a.

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 [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.

Signatories

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

(Signatories as of publication date. Institutional affiliations are provided for identification purposes only.)

Ovokeroye Abafe, Researcher, School of Chemistry and Physics, University of Kwazulu-Natal, Durban, South Africa

Marlene Ågerstrand, PhD, Researcher, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Lutz Ahrens, PhD, Research Scientist, Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden

Beatriz H. Aristizabal, PhD, Professor, Department of Chemical Engineering, National University of Colombia, Manizales, Colombia

Abel Arkenbout, PhD, Chairman, ToxicoWatch Foundation, Harlingen, the Netherlands

Misha Askren, MD, Physician, Urgent Care, Kaiser Permanente, Los Angeles, California, USA

Jannicke Bakkejord, Senior Engineer, National Institute of Nutrition and Seafood Research, Bergen, Norway

Georg Becher, PhD, Professor Emeritus, Department of Exposure and Risk Assessment, Norwegian Institute of Public Health, Oslo, Norway

Thea Bechshoft, PhD, Postdoctoral Fellow, University of Southern Denmark, Odense, Denmark

Peter Behnisch, PhD, Director, BioDetection System, Amsterdam, the Netherlands

Susanne Bejerot, MD, Assistant Professor, Department of Clinical Neuroscience, Karolinska Institute, Stockholm, Sweden

Stephen Bent, MD, Associate Professor of Medicine, Epidemiology and Biostatistics, and Psychiatry, University of California at San Francisco, San Francisco, California, USA

Urs Berger, PhD, Associate Professor, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Åke Bergman, PhD, Executive Director and Professor, Swedish Toxicology Sciences Research Center, Södertälje, Sweden

Vladimir Beškoski, PhD, Assistant Professor, Faculty of Chemistry, University of Belgrade, Belgrade, Serbia

Emmanuelle Bichon, Scientific and Technical Support Manager, Oniris, Nantes-Atlantic College of Veterinary Medicine, Food Science and Engineering, Nantes, France

Filip Bjurlid, PhD Student, Man–Technology–Environment Research Centre, Örebro University, Örebro, Sweden

Tara Blank, PhD, Consultant, Elixir Environmental, Ridgefield, Connecticut, USA

Daniel Borg, PhD, Toxicology Consultant, Trossa AB, Stockholm, Sweden

Carl-Gustaf Bornehag, PhD, Professor, Department of Health and Environment, Karlstad University, Karlstad, Sweden

Hindrik Bouwman, PhD, Lecturer, Zoology Group, North-West University, Mahikeng, South Africa

Lindsay Bramwell, MSc, Research Associate, Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom

Knut Breivik, PhD, Senior Scientist and Professor, NILU–Norwegian Institute for Air Research, Kjeller, Norway

Katja Broeg, PhD, Researcher, Baltic Sea Centre, Stockholm University, Stockholm, Sweden

Phil Brown, PhD, University Distinguished Professor of Sociology and Health Sciences, and Director, Social Science Environmental Health Research Institute, Northeastern University, Boston, Massachusetts, USA

Thomas Bruton, MS, PhD Student, Department of Civil and Environmental Engineering, University of California, Berkeley, Berkeley, California, USA

David Camann, MS, Technical Advisor, Southwest Research Institute, San Antonio, Texas, USA

Louise Camenzuli, PhD Student, Safety and Environmental Technology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland

Argelia Castaño, PhD, Head of Department, Area of Environmental Toxicology, Instituto de Salud Carlos III, Majadahonda, Spain

Carmela Centeno, Industrial Development Officer, United Nations Industrial Development Organization, Vienna, Austria

Ibrahim Chahoud, PhD, Professor, Department of Toxicology, Charité–Universitätsmedizin Berlin, Berlin, Germany

Kai Hsien Chi, PhD, Associate Professor, Institute of Environmental and Occupational Health Sciences, National Yang-Ming University, Taipei, Taiwan

Eliza Chin, MD, MPH, Executive Director, American Medical Women's Association, Reston, Virginia, USA

Carsten Christophersen, PhD, Adjunct Professor, Systems Biology, Technical University of Denmark, Kongens Lyngby, Denmark

Theo Colborn (1927–2014), PhD, President Emeritus, TEDX (The Endocrine Disruption Exchange), Paonia, Colorado, USA

Terrence J. Collins, PhD, Teresa Heinz Professor of Green Chemistry, Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA, USA; and Director, Institute for Green Science, Pittsburgh, Pennsylvania, USA

Johanna Congleton, MSPH, PhD, Senior Scientist, Environmental Working Group, Washington, DC, USA

Adrian Covaci, PhD, Professor, Toxicological Center, University of Antwerp, Antwerp, Belgium

Craig Criddle, PhD, Professor, Department of Civil and Environmental Engineering, Stanford University, Stanford, California, USA

Oscar H. Fernández Cubero, Technician, National Food Center, Majadahonda, Spain

Jordi Dachs, PhD, Research Scientist, Institute of Environmental Assessment and Water Research, Spanish Council for Scientific Research, Barcelona, Spain

Cynthia de Wit, PhD, Professor, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Barbara Demeneix, PhD, DSc, Professor, Department RDDM, National Museum of Natural History, Paris, France

Pascal Diefenbacher, PhD Student, Safety and Environmental Technology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland

Michelle Douskey, PhD, Chemistry Lecturer, Department of Chemistry, University of California, Berkeley, Berkeley, California, USA

Timothy Elgren, PhD, Dean of Arts and Sciences, Oberlin College, Oberlin, Ohio, USA

David Epel, PhD, Professor Emeritus, Hopkins Marine Station, Stanford University, Pacific Grove, California, USA

Ulrika Eriksson, PhD Student, Man–Technology–Environment Research Centre, Örebro University, Örebro, Sweden

Alexi Ernstoff, MS, PhD Student, Quantitative Sustainability Assessment, Technical University of Denmark, Kongens Lyngby, Denmark

Igor Eulaers, PhD Student, Department of Biology, University of Antwerp, Antwerp, Belgium

Heesoo Eun, PhD, Senior Researcher, Division of Organochemicals, National Institute for Agro-Environmental Sciences, Tsukuba, Japan

Peter Fantke, PhD, Assistant Professor, Quantitative Sustainability Assessment Division, Department of Management Engineering, Technical University of Denmark, Kongens Lyngby, Denmark

Marko Filipovic, FilLic, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Marie Frederiksen, Researcher, Danish Building Research Institute, Aalborg University, Copenhagen, Denmark

Carey Friedman, PhD, Postdoctoral Associate, Center for Global Change Science, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Frederic Gallo, PhD, Senior Expert, Regional Activity Center for Sustainable Consumption and Production, Barcelona, Spain

Joseph A. Gardella, Jr, PhD, Distinguished Professor and John and Frances Larkin Professor of Chemistry, Department of Chemistry, University of Buffalo–The State University of New York, Buffalo, New York, USA

Stephen Gardner, DVM, Veterinarian, Albany Animal Hospital, Richmond, California, USA

Caroline Gaus, PhD, Professor, National Centre for Environmental Toxicology, The University of Queensland, Brisbane, Queensland, Australia

Wouter Gebbink, PhD, Researcher, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

David Gee, PhD, Associate Fellow, Institute of Environment, Health, and Societies, Brunel University, Brunel, United Kingdom

Philip Germanseder, DHC Che, MS ChE, Director of International Sales and Marketing, Fluid Management Systems, Inc., Watertown, Massachusetts, USA

Bondi Nxuma Gevao, PhD, Research Scientist, Kuwait Institute for Scientific Research, Safat, Kuwait

Melissa Gomis, MS, PhD Student, Department of Environmental Science, Stockholm University, Stockholm, Sweden

Belen Gonzalez, PhD Student, Institute of Environmental Assessment and Water Research, Spanish Council for Scientific Research, Barcelona, Spain

Peter Gringinger, MSc, Principal, Cardno, Sassafras, Victoria, Australia

Adam Grochowalski, PhD, Professor, Department of Analytical Chemistry, Krakow University of Technology, Krakow, Poland

Ramon Guardans, Scientific Advisor, Ministry of Agriculture, Food and Environment, Madrid, Spain

Alexey Gusev, PhD, Senior Scientist, European Monitoring and Evaluation Programme Meteorological Synthesizing Centre–East, Moscow, Russia

Arno Gutleb, PhD, Project Leader, Department of Environment and Agro-Biotechnologies, Luxembourg Institute of Science and Technology, Belvaux, Luxembourg

Tenzing Gyalpo, PhD Student, Safety and Environmental Technology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland

Johannes Hädrich, PhD, Head, Research Laboratory, European Union Reference Laboratory for Dioxins and PCBs in Feed and Food, Freiburg, Germany

continued »

Signatories

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

(continued)

(Signatories as of publication date. Institutional affiliations are provided for identification purposes only.)

Helen Håkansson, PhD, Professor of Toxicology and Chemicals Health Risk Assessment, Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden

Tomas Hansson, PhD, Researcher, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Mikael Harju, PhD, Senior Scientist, NILU–Norwegian Institute for Air Research, Tromsø, Norway

Stuart Harrad, PhD, Professor of Environmental Chemistry, School of Geography, Earth and Environmental Sciences, University of Birmingham, Edgbaston, United Kingdom

Bernhard Hennig, PhD, Professor of Nutrition and Toxicology, and Director, University of Kentucky Superfund Research Center, Lexington, Kentucky, USA

Eunha Hoh, PhD, Associate Professor, Department of Public Health, San Diego State University, San Diego, California, USA

Sandra Huber, PhD, Senior Researcher, Environmental Chemistry, NILU–Norwegian Institute for Air Research, Tromsø, Norway

François Idczak, Direction de la Surveillance de l'Environnement, Institut Scientifique de Service Public (ISSEP), Liege, Belgium

Alastair Iles, SJD, Associate Professor, Department of Environmental Science, Policy, and Management, University of California, Berkeley, Berkeley, California, USA

Ellen Ingre-Khans, MSc, PhD Student, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Alin Constantin Ionas, PhD Candidate, Toxicological Center, University of Antwerp, Antwerp, Belgium

Griet Jacobs, Researcher, Flemish Institute of Technological Research, Mol, Belgium

Annika Jahnke, PhD, Researcher, Department of Cell Toxicology, Helmholtz Centre for Environmental Research, Leipzig, Germany

Veerle Jaspers, PhD, Associate Professor, Department of Biology, Norwegian University of Science and Technology, Trondheim, Norway

Allan Astrup Jensen, PhD, Research Director and CEO, Nipsect, Frederiksberg, Denmark

Javier Castro Jimenez, PhD Research Scientist, Institute of Environmental Assessment and Water Research, Spanish Council for Scientific Research, Barcelona, Spain

Ingrid Ericson Jogsten, PhD, Research Scientist, School of Science and Technology, Örebro University, Örebro, Sweden

Jon E. Johansen, Dr techn, Director, Chiron AS, Trondheim, Norway

Niklas Johansson, Senior Consultant, Melica Biologkonsult, Upplands Väsby, Sweden

Paula Johnson, PhD, MPH, Research Scientist, California Department of Public Health, Richmond, California, USA

Jill Johnston, PhD, Postdoctoral Fellow, Department of Epidemiology, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

Olga-Ioanna Kalantzi, PhD, Assistant Professor, University of the Aegean, Mytilene, Greece

Anna Kärrman, PhD, Associate Professor, Man–Technology–Environment Research Centre, Örebro University, Örebro, Sweden

Naila Khalil, MBBS, MPH, PhD, Assistant Professor, Boonshoft School of Medicine, Wright State University, Kettering, Ohio, USA

Maja Kirkegaard, PhD, Cand Scient, Research Advisory, Head of Chemicals Group, Worldwatch Institute Europe, Copenhagen, Denmark

Jana Klanova, PhD, Professor, Research Center for Toxic Compounds in the Environment, Faculty of Science, Masaryk University, Brno, Czech Republic

Susan Klosterhaus, PhD, Vice President, Science and Certification, Cradle to Cradle Products Innovation Institute, San Francisco, California, USA

Candice Kollar, LEED AP, Design Strategist, Kollar Design | EcoCreative, San Francisco, California, USA

Janna G. Koppe, PhD, Professor Emeritus of Neonatology, Emma Children's Hospital/Academic Medical Center, University of Amsterdam, Loenersloot, the Netherlands

Ingjerd Sunde Krogseth, PhD, Postdoctoral Fellow, NILU–Norwegian Institute for Air Research, Tromsø, Norway

Petr Kukucka, PhD, Junior Researcher, Research Center for Toxic Compounds in the Environment, Faculty of Science, Masaryk University, Brno, Czech Republic

Perihan Binnur Kurt Karakus, PhD, Associate Professor, Department of Environmental Engineering, Bursa Technical University, Bursa, Turkey

Henrik Kylin, PhD, Professor, Department of Thematic Studies—Environmental Change, Linköping University, Linköping, Sweden

Remi Laane, PhD, Professor, Department of Environmental Chemistry, University of Amsterdam, Deltares, Voorburg, the Netherlands

Jon Sanz Landaluze, PhD, Assistant Professor, Department of Analytical Chemistry, Universidad Complutense de Madrid, Madrid, Spain

Le Thi Hai Le, PhD, Department Deputy Director, Ministry of Natural Resources and Environment, Ha Noi, Vietnam

Jong-Hyeon Lee, PhD, Director, NeoEnBiz, Gyeonggi-do, South Korea

Marika Martina Leijts, PhD, Professor, Department of Dermatology, University Hospital RWTH Aachen, Aachen, Germany

Xiaodong Li, PhD, Professor, Faculty of Engineering, Zhejiang University, Hangzhou, China

Yifan Li, PhD, Professor, International Joint Research Center for Persistent Toxic Substances, Harbin Institute of Technology, Harbin, China

Danuta Ligocka, PhD, Senior Researcher, Department of Toxicology and Carcinogenesis, Nofer Institute of Occupational Medicine, Łódź, Poland

Monica Lind, PhD, Scientist, Occupational and Environmental Medicine, Uppsala University, Uppsala, Sweden

Lee Lippincott, PhD, Assistant Professor of Chemistry, Allied Health Sciences, Mercer County Community College, West Windsor, New Jersey, USA

Mariann Lloyd-Smith, PhD, Senior Advisor, National Toxics Network, East Ballina, New South Wales, Australia

Karin Löfstrand, PhD, Postdoctoral Fellow, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Rainer Lohmann, PhD, Associate Professor, Graduate School of Oceanography, University of Rhode Island, Kingston, Rhode Island, USA

Donald Lucas, PhD, Research Scientist, Lawrence Berkeley National Laboratory, Berkeley, California, USA

José Vinicio Macias, PhD, Researcher, Autonomous University of Baja California, Baja California, Mexico

Karl Mair, Magister, Senior Environmental Chemist, Eco Research, Bolzano, Italy

Govindan Malarvannan, PhD, Research Scientist, Faculty of Pharmaceutical, Biomedical and Veterinary Sciences, University of Antwerp, Antwerp, Belgium

Svetlana Malysheva, PhD, Research Scientist, Scientific Institute of Public Health, Ghent University, Brussels, Belgium

Jonathan Martin, PhD, Professor, Division of Analytical and Environmental Toxicology, University of Alberta, Edmonton, Alberta, Canada

Lisa Mattioli, MSc, Scientist, Department of Chemistry, Carleton University Ottawa, Ontario, Canada

Michael McLachlan, PhD, Professor, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Lisa Melymuk, PhD, Junior Researcher, Research Center for Toxic Compounds in the Environment, Faculty of Science, Masaryk University, Brno, Czech Republic

Annelle Mendez, PhD Student, Safety and Environmental Technology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland

Tom Muir, MS, Consultant (retired), Environment Canada, Burlington, Ontario, Canada

Marie Danielle Mulder, PhD Student, Research Center for Toxic Compounds in the Environment, Faculty of Science, Masaryk University, Brno, Czech Republic

Jochen Müller, PhD, Professor, National Research Centre for Environmental Toxicology, The University of Queensland, Brisbane, Queensland, Australia

Patricia Murphy, ND, LAc, Naturopathic Physician, Portland, Oregon, USA

Takeshi Nakano, PhD, Specially Appointed Professor, Graduate School of Engineering, Osaka University, Osaka, Japan

Amgalan Natsagdorj, PhD, Associate Professor, Department of Chemistry, National University of Mongolia, Ulaanbaatar, Mongolia

Seth Newton, PhD Student, Department of Applied Environmental Science, Stockholm University, Täby, Sweden

Carla Ng, PhD, Senior Scientist, Safety and Environmental Toxicology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland

Bo Normander, PhD, Executive Director, Worldwatch Institute Europe, Copenhagen, Denmark

Kees Olie, PhD, Retired, Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, the Netherlands

Bindu Panikkar, PhD, Research Associate, Arctic Institute of North America, Calgary, Alberta, Canada

Richard Peterson, PhD, Professor, Department of Pharmaceutical Sciences, University of Wisconsin, Madison, Wisconsin, USA

Arianna Piersanti, PhD, Lead Chemist, Food of Environmental Control Department, Istituto Zooprofilattico Sperimentale dell'Umbria e della Marche, Perugia, Italy

Merle Plassmann, PhD, Researcher, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Anuschka Polder, PhD, Scientist, Department of Food Safety and Infection Biology, Norwegian University of Life Sciences, Oslo, Norway

continued »

Signatories

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

(continued)

(Signatories as of publication date. Institutional affiliations are provided for identification purposes only.)

Malte Posselt, BSc, MS Student, German Federal Environment Agency, Berlin, Germany

Deborah O. Raphael, Director, San Francisco Department of the Environment, San Francisco, California, USA

Shay Reicher, PhD, Risk Assessment Director, Ministry of Health, Tel Aviv, Israel

Efstathios Reppas-Chrysovisinos, MEng, PhD Candidate, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Crystal Reul-Chen, DEnv, Senior Environmental Scientist, California Environmental Protection Agency, Sacramento, California, USA

David Roberts, PhD, Kenan Professor of Physics, Department of Physics, Brandeis University, Waltham, Massachusetts, USA

Mary Roberts, PhD, Professor, Merkert Chemistry Center, Boston College, Chestnut Hill, Massachusetts, USA

Camilla Rodrigues, PhD, Researcher, Environmental Sanitation Technology Company, San Paulo, Brazil

Ott Roots, Dr sc nat ETH, Director of the Institute/Leading Research Scientist, Estonian Environmental Research Institute, Tallinn, Estonia

Maria Ros Rodriguez, Laboratory Technician, Instituto de Química Orgánica General-Consejo Superior de Investigaciones Científicas, Madrid, Spain

Anna Rotander, PhD, Postdoctoral Researcher, Man-Technology-Environment Research Centre, Örebro University, Örebro, Sweden; and National Research Centre for Environmental Toxicology, The University of Queensland, Brisbane, Queensland, Australia

Ruthann Rudel, MS, Director of Research, Silent Spring Institute, Newton, Massachusetts, USA

Christina Rudén, PhD, Professor, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Andreas Béguin Safron, MSc, PhD Candidate, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Amina Salamova, PhD, Research Scientist, School of Public and Environmental Affairs, Indiana University, Bloomington, Indiana, USA

Samira Salihovic, PhD, Postdoctoral Fellow, Department of Medical Sciences, Uppsala University, Uppsala, Sweden

Johanna Sandahl, MS, President, Swedish Society for Nature Conservation, Stockholm, Sweden

Erik Sandell, Consulting Specialist, Nab Labs Oy, Espoo, Finland

Andreas Schaeffer, PhD, Institute Director, Institute for Environmental Research, RWTH Aachen University, Aachen, Germany

Julia Schaletzky, PhD, Senior Group Leader, Cytokinetics, South San Francisco, California, USA

Arnold Schecter, PhD, Professor, School of Public Health, University of Texas-Dallas Campus, Dallas, Texas, USA

Ted Schettler, MD, MPH, Science Director, Science and Environmental Health Network, Ames, Iowa, USA

Margret Schlumpf, Dr sc nat ETH, Co-Director, Group for Reproductive, Endocrine and Environmental Toxicology, University of Zürich, Zürich, Switzerland

Peter Schmid, PhD, Senior Scientist, Department of Organic Chemistry, Swiss Federal Institute for Material Research and Testing, Dübendorf, Switzerland

Lara Schultes, MSc, PhD Student, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Susan Shaw, PhD, Professor, School of Public Health, University at Albany-State University of New York, Albany, New York, USA; and Director, Marine Environmental Research Institute, Blue Hill, Maine, USA

Omotayo Sindiku, Research Assistant, Basel Convention Coordinating Center, Ibadan, Nigeria

Line Småstuen Haug, PhD, Senior Scientist, Department of Exposure and Risk Assessment, Norwegian Institute of Public Health, Oslo, Norway

Anna Sobek, PhD, Researcher, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Ana Sousa, PhD, Postdoctoral Researcher, Health Sciences Research Centre, University of Beira Interior, Covilhã, Portugal

Martin Sperl, Technician, Austria Metall AG, Ranshofen, Austria

Thomas Steiner, PhD, CEO, MonitoringSystems GmbH, Pressbaum, Austria

Christine Steinlin, PhD Student, Safety and Environmental Technology Group, Institute for Chemical and Bioengineering, ETH Zürich, Zürich, Switzerland

Alex Stone, ScD, Senior Chemist, Hazardous Waste and Toxics Reduction Program, Washington State Department of Ecology, Lacey, Washington, USA

William Stubbings, PhD Student, University of Birmingham, Edgbaston, United Kingdom

Roxana Sühling, PhD Student, Helmholtz-Zentrum Geesthacht, Lüneburg, Germany

Kimmo Suominen, PhD, Senior Researcher, Finnish Food Safety Authority, Risk Assessment Research Unit, Helsinki, Finland

Rebecca Sutton, PhD, Senior Scientist, San Francisco Estuary Institute, Richmond, California, USA

Joel Svedlund, BSc, Sustainability Manager, Klättermusen AB, Åre, Sweden

David Szabo, PhD, Senior Scientist, Research and Development, Reynolds American, Winston-Salem, North Carolina, USA

Öner Tatli, Lab Manager, A&G Pür Analysis Laboratory, Izmir, Turkey

Neeta Thacker, MSc, PhD, Former Chief Scientist and Quality Manager, Analytical Instruments Division, National Environmental Engineering Research Institute, Nagpur, India

Dien Nguyen Thanh, PhD Student, Environment Preservation Research Center, Kyoto University, Kyoto, Japan

Joao Paulo Machado Torres, PhD, Associate Professor, Instituto de Biofísica Carlos Chagas Filho, Rio de Janeiro Federal University, Rio de Janeiro, Brazil

Matthew Trass, PhD, Research Scientist, Phenomenex, Torrance, California, USA

Theodora Tsongas, PhD, MS, Environmental Health Scientist and Consultant, Portland, Oregon, USA

Mary Turyk, PhD, Associate Professor, Department of Epidemiology and Biostatistics, University of Illinois at Chicago, Chicago, Illinois, USA

Anthony C. Tweedale, MS, Consultant, Rebutting Industry Science with Knowledge Consultancy, Eastpointe, Michigan, USA

Marta Venier, PhD, Scientist, School of Public and Environmental Affairs, Indiana University, Bloomington, Indiana, USA

Robin Vestergren, PhD, Postdoctoral Researcher, Environmental Chemistry, NILU-Norwegian Institute for Air Research, Tromsø, Norway

Stefan Voorspoels, PhD, Research Manager, Flemish Institute of Technological Research, Mol, Belgium

Shu-Li Wang, PhD, Investigator and Professor, Department of Environmental Health and Occupational Medicine, National Health Research Institute, Chunan, Miaoli, Taiwan

Glenys Webster, PhD, Postdoctoral Fellow, Developmental Neurosciences and Child Health, Child and Family Research Institute, and Faculty of Health Sciences, Simon Fraser University, Vancouver, British Columbia, Canada

Larry Weiss, MD, Chief Marketing Officer, AOBiome, LLC, San Francisco, California, USA

Philip White, Organics Analyst, Marine Institute, Galway, Ireland

Karin Wiberg, PhD, Professor, Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden

Gayle Windham, PhD, Research Scientist, Division of Environmental and Occupational Health Control, California Department of Public Health, Richmond, California, USA

Hendrik Wolschke, PhD Student, Helmholtz Zentrum Geesthacht-Centre for Materials and Coastal Research, Geesthacht, Germany

Bo Yuan, PhD, Postdoctoral Fellow, Department of Applied Environmental Science, Stockholm University, Stockholm, Sweden

Elena Zaffonato, Organics Analyst, Chelab Sri, Resana Treviso, Italy

Lingyan Zhu, PhD, Professor, College of Environmental Science and Engineering, Nankai University, Tianjin, China

Robert Zoeller, PhD, Professor, Department of Biology, University of Massachusetts Amherst, Amherst, Massachusetts, USA