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Committee on Oversight and Reform
Subcommittee on Environment

"The Devil They Knew – PFAS Contamination and the Need for Corporate Accountability"

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Brief Summary of PFAS

Per- and polyfluoroalkyl substances (PFAS) are described as “forever chemicals” due to their persistence in the environment. They aren’t readily broken down by sunlight, microbes, or other processes. We, as a scientific community, have not yet uncovered an easy and inexpensive way by which these chemicals can be broken down to something that isn’t a PFAS, so forever chemical is an appropriate description of PFAS. In addition, many of the more than 5,000 members of this class of chemicals are highly mobile once released to the environment. PFAS have been found everywhere scientists have looked, from the Arctic Circle to the Marianas Trench.

Exposure occurs when PFAS move from the environment or products containing PFAS into the bodies of plants and animals, including people. Some PFAS accumulate in blood and tissues of living organisms. Because PFAS are so long-lasting in our environment, scientists do not yet know all of the ways we are exposed. What we do know is that exposure begins in the womb, before we are born. Exposures then continue throughout the course of a person’s lifetime. Many Americans are exposed daily from sources such as the water they drink, consumer products, contaminated dust from homes, and food packaging that contains PFAS. Given that they are forever chemicals, even if production is stopped today, human exposure will be ongoing into the distant future. PFAS also are slow to be excreted from human bodies and some PFAS can take years to leave human bodies. Therefore, concerns for human health are not going away.

Once in our bodies, PFAS interact with a wide range of molecules and biological systems to produce multiple types of adverse health effects. Studies of humans exposed because they work with PFAS, live in areas of that have high levels of PFAS in the environment, or even of humans who are exposed by everyday activities have uncovered adverse health effects to include: kidney and testicular cancer, decreased antibody responses to vaccines, liver damage, changes in serum lipids and cholesterol, increased risk of thyroid disease, increased risk of asthma, increased risk of decreased fertility, decreases in birth weight, and increased risk of pregnancy-induced hypertension and preeclampsia. PFAS are truly “multi-system toxicants.” These forever chemicals possess tremendous risks to Public Health – they are Persistent in the environment and in human bodies; they Bioaccumulate from the environment into the bodies of living organisms,

including humans; and they are Toxic and able to produce adverse health effects in humans and wildlife.

Phasing out some of the PFAS, such as perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), and others that have a high number of carbons is a step in the right direction, but the PFAS that are being produced as replacements share many of the same characteristics – they also are persistent, some accumulate, and we are learning more about their toxicity. However, these replacement PFAS are still persistent in the environment; PFAS are not going to go away. People will be exposed across generations and as a result, their production should be limited to essential uses only and steps should be taken to find suitable replacements that are not persistent or have other hazardous properties.

Testimony

Chairman Rouda, Ranking Member Comer, and Distinguished Members of the Subcommittee on Environment, good afternoon and thank you for inviting me to speak with you about health effects of exposure to PFAS, chemicals that have been found everywhere scientists have looked. My name is Dr. Jamie DeWitt and I'm an Associate Professor of Pharmacology and Toxicology at the Brody School of Medicine of East Carolina University in Greenville, North Carolina.

PFAS are a class of, at last estimates, over 5,000 individual chemicals that all contain a carbon-fluorine bond that makes them highly stable, heat and chemical resistant, and versatile in manufacturing processes and consumer goods[1]. This bond helps to provide the functional characteristics of PFAS-containing products and also makes PFAS extremely long-lived in our environment and our bodies because they do not readily break down. This means that although PFAS appear to be diverse in terms of the number of carbons, oxygens, and functional groups, their principal families are interrelated as industrial, environmental, or metabolic precursors or transformation products of one another[2].

When persistent chemicals are released into the environment and contaminate food and water resources, the problem of clean-up often becomes even more challenging. If the chemicals don't readily break down, the solution is typically filter, capture, and transport to another location. PFAS filtered out of drinking water and captured, for example, by carbon filters, often are incinerated; however, incineration may not completely break down PFAS[3]. Until scientists find a way to cost-effectively destroy PFAS in large-scale settings such as drinking water treatment facilities, PFAS contamination will persist and Americans will continue to be exposed into the distant future. I would like to paraphrase Dr. Anna Lennquist, a Senior Toxicologist at the non-profit organization International Chemical Secretariat, who recently wrote that the real dilemma with persistent chemicals is that if we

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[1] Wang Z, DeWitt JC, Higgins CP, Cousins IT. 2017. A never-ending story of per- and polyfluoroalkyl substances (PFASs)? *Environmental Science & Technology*. 51:2508-2518.

[2] Buck RC, Franklin J, Berger U, Conder JM, Cousins IT, de Voogt P, Jensen AA, Kannan K, Mabury SA, van Leeuwen SP. 2011. Perfluoroalkyl and polyfluoroalkyl substances in the environment: terminology, classification, and origins. *Integrated Environmental Assessment and Management*. 7:513-541.

[3] Jansen K. 2019. 'Forever chemicals' no more? These technologies aim to destroy PFAS in water. *Chemical &Engineering News.* Available online at: https://cen.acs.org/environment/persistent-pollutants/Forever-chemicals-technologies-aim-destroy/97/i12.

fail to appreciate their toxicity today and find out later that they that they are indeed toxic, as has happened numerous times in the past, it will be too late; continual exposure to toxic persistent chemicals will eventually increase the risk of adverse health effects[4].

I first started studying effects of PFAS on the immune system in 2005. Part of the research process for any scientific experiment is to learn from the published scientific literature to uncover the kinds of experiments that have been done, what is known, and what needs to be known. When you start digging through the scientific literature, you often take a trip back in time and find yourself on some side trips outside of the published scientific literature. With respect to the immune system, some of the earliest reports of immunotoxicity of PFAS, specifically perfluorooctanoic acid or PFOA, were published in the early 2000s[5][6][7]. These were studies of mice given PFOA in their food that reported profound effects on immune organs as well as the ability of the immune system to produce antibodies to vaccines. However, I later found out about studies performed in 1978 that demonstrated immune-related changes in monkeys and rats given PFOA or a related PFAS for 90 days[8][9]. These earlier studies told me that knowledge about the immunotoxicity of PFAS existed in the late 70s but was not part of the published literature at that time. We are now finding PFAS in drinking water and in human bodies for which no published toxicological data are available and I have to ask myself, are there data out there about their toxicity that have not yet been shared with the scientific community? I do know that some industries manufacturing PFAS have submitted data concerning new PFAS to the US Environmental Protection Agency as part of the pre-manufacture notice; however it is likely

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[4] Lennquist A. 2019. If PFAS are so bad, why aren't they regulated? ChemSec. Available online at: https://chemsec.org/if-pfas-are-so-bad-why-arent-they-regulated/

[5] Yang Q, Xie Y, DePierre JW. 2000. Effects of peroxisome proliferators on the thymus and spleen of mice. *Clinical and Experimental Immunology*. 122:219-226.

[6] Yang Q, Xie Y, Eriksson AM, Nelson BD, DePierre JW. 2001. Further evidence for the involvement of inhibition of cell proliferation and development in thymic and splenic atrophy induced by the peroxisome proliferatore perfluorooctanoic acid in mice. *Biochemical Pharmacology*. 62:1133-1140.

[7] Yang Q, Abdel-Valugerdi M, Xie Y, Zhao XY, Möller G, Nelson BD, DePierre JW. 2002. Potent suppression of the adaptive immune response in mice upon dietary exposure to the potent peroxisome proliferator, perfluorooctanoic acid. *International Immunopharmacology*. 2:389-397.

[8] Goldenthal EI, Jessup DC, Geil RG, Mehring JS. Final report, Ninety day subacute rhesus monkey toxicity study, International Research and Development Corporation, Study No. 137-090. 1978. US EPA Administrative Record AR226-0447. Cited in US EPA 2005 draft risk assessment of PFOA.

[9] Goldenthal EI, Jessup DC, Geil RG, Mehring JS. Ninety day subacute rat toxicity study on Fluorad Fluorochemical FC-143, International Research and Development Corporation, Study No. 137-089. 1978. US EPA Administrative Record AR226-0441. Cited in US EPA 2005 draft risk assessment of PFOA.

claimed as confidential business information. Thus some know of this select information but most, like me and members of the general public, do not.

Regarding human health effects of PFAS, our scientific understanding is still growing. Concerted efforts among teams of researchers dedicated to expanding our understanding of PFAS and their health effects is creating a baseline of health effects by which we can compare other PFAS. A comprehensive evaluation of the toxicological data for 14 different PFAS compiled by the Agency for Toxic Substances and Disease Registry[10] reported a wide variety of health effects in people exposed because they work with PFAS, live in areas of that have high levels of PFAS in the environment, or even those exposed from everyday activities. These health effects include effects on the liver, the cardiovascular, endocrine, immune, and reproductive systems, and on development. Some populations have also seen increases in kidney and testicular cancer associated with PFAS exposure. These adverse health effects also have been observed in experimental animals exposed to individual PFAS through food or water, which are supportive of these findings of adverse health effects in humans. Finally, it's important to note that as these health effects are being seen at levels lower than the US EPA Health Advisory Level of 70 parts per trillion (ng/L) set in 2016[11], we now know that this level is not health protective for all Americans.

Following the voluntary removal of PFOA and highly related PFAS from production processes and products, levels of these PFAS have decreased in the environment and in our bodies. However, since that time, replacement PFAS have increased in production, we are identifying more PFAS in the environment, and we are finding these replacement and understudied PFAS in the bodies of people who live near PFAS production facilities, such as people like Emily Donovan who live in the Wilmington area of North Carolina[12]. We need to learn more about these replacement compounds, find out about data that already exists but is not yet part of the

[10] Agency for Toxic Substances and Disease Registry Toxicological Profile for Perfluoroalkyls, Draft for Public Comment, 2018, https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=1117&tid=237.
[11] US EPA, 2016, FACT SHEET, PFOA & PFOS Drinking Water Health Advisories, EPA-800-F-16-003.
[12] GenX Exposure Study PFAS blood sample results, November 2018. Available online at https://chhe.research.ncsu.edu/wordpress/wp-content/uploads/2018/11/Community-event-BLOOD-slides.pdf.

published literature, and ask ourselves, "are these essential for the public good?"[13] We also have to consider the costs of inaction with respect to PFAS. A recent report to the Nordic Council of Ministers, co-authored by Gretta Goldenman, one of my colleagues from the Global PFAS Science Panel, estimated that annual health-related costs of 52-84 billion Euros for the European Economic Area countries (which is approximately $58-94 billion USD at current exchange rates)[14]. These replacement PFAS are still persistent, are difficult to remove from resources, and have enhanced mobility and solubility that will lead to increased human exposures. This continual exposure to these persistent chemicals may increase the risk of adverse health effects. These health effects may lead to health-related costs that will eventually be shouldered by public authorities and tax payers[14]. We need to find out now about toxicity data that will help our country to avoid catastrophic costs associated with adverse health effects of exposure to persistent PFAS. More importantly, we need to eliminate PFAS exposure so that people like Emily Donovan can live without constant fear for the health of her family. Thank you for listening to me this afternoon.

[13] Cousins IT, Goldenman G, Herzke D, Lohmann R, Miller M, Ng, CA, Patton S, Scheringer M, Trier X, Vierke L, Wang Z, and DeWitt JC. 2019. The concept of essential use for determining when uses of PFASs can be phased out. *Environmental Science: Processes & Impacts.* doi: 10.1039/c9em00163h

[14] Goldenman G, Fernandes M, Holland M, Tugran T, Nordin A, Schoumacher C, McNeill A. 2019. The cost of inaction: A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS. Nordic Council of Ministers. Available online at: http://norden.diva-portal.org/smash/record.jsf?faces-redirect=true&aq2=%5B%5B%5D%5D&af=%5B%5D&searchType=SIMPLE&sortOrder2=title_sort_asc&query=&language=en&pid=diva2%3A1295959&aq=%5B%5B%5D%5D&sf=all&aqe=%5B%5D&sortOrder=author_sort_asc&onlyFullText=false&noOfRows=50&dswid=-1306

Appendix

In a recent editorial by Philippe Grandjean, an academic scientist who studies health effects of environmental contaminants in human populations, early data on adverse health effects of PFAS were collected, but were not part of the publicly available peer-reviewed literature.

Table 1 Time course of important developments regarding PFAS exposure and health risks [5, 6, 8, 10, 11, 13, 15, 16, 28, 31, 32, 44, 50]

Year	Exposure evidence	Reference
1968	Organic fluoride compounds discovered in human blood	[11]
1976	Organofluorines determined in blood from production workers	[10]
1981	PFOA found in umbilical cord blood when female worker gives birth	[13]
1993	Transfer of PFOS into milk observed in goats	[10]
1998	PFOS found in blood from the general population	[10]
2003	PFAS in blood from Red Cross blood donors	[16]
2004	PFAS detected in human milk	[15]
2014	Breastfeeding shown to be major source of PFAS exposure in infants	[31]
	Immunotoxicity	
1978	Immunotoxicity and other adverse effects in monkeys exposed to PFOA, and mortality in monkeys exposed to PFOS	[5, 6]
1992	Leukocyte cell count changes in PFOA production workers	[8]
2008	Mouse study shows immunotoxicity at serum PFAS concentrations similar to elevated human exposures	[50]
2012	Immunotoxicity reported in PFAS-exposed children	[28]
2013	Benchmark Dose calculations suggest that guidelines are far from protective	[44]
2017	PFAS exposure during infancy associated with subsequent immune deficiency	[32]

Unpublished information is shaded

Table 1 From: Grandjean P. 2018. Delayed discover, dissemination, and decisions on intervention in environmental health: a case study on immunotoxicity of perfluorinated alkylate substances. *Environmental Health*. 17:62. https://doi.org/10.1186.s12940-018-0405-y.

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Goldenthal EI, Jessup DC, Geil RG, Mehring JS. Ninety-day subacute rat toxicity study, with Fluorad® Fluorochemical Surfactant FC-95, International Research and Development Corporation, project No. 137–085, December 18, 1978, U.S. EPA Administrative Record, AR226–0137. 1978.

Gilliland FD. Fluorocarbons and human health: studies in an occupational cohort. Minnesota: University of Minnesota; 1992.

Grandjean P. Expert report. Minneapolis: State of Minnesota District Court for the County of Hennepin Fourth Judicial District; 2017. Civil Action No. 27-cv-10-28862, State of Minnesota, et al. v. 3M Company

PFCs. Global contaminants: PFOA is a pervasive pollutant in human blood, as are other PFCs [https://www.ewg.org/research/pfcs-global-contaminants/pfoa-pervasive-pollutant-human-blood-are-other-pfcs].