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Subcommittee on Military Construction, Veterans Affairs, and Related Agencies

"Remediation and Impact of PFAS"

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Testimony

Distinguished Members of the Subcommittee on Military Construction, Veterans Affairs, and Related Agencies, thank you for the opportunity to testify on contamination and impact of PFAS from closed military installations and effects of PFAS on Veterans who were exposed to PFAS during their service. My name is Dr. Jamie DeWitt and I am an Associate Professor of Pharmacology and Toxicology at the Brody School of Medicine of East Carolina University (ECU) in Greenville, North Carolina. In my laboratory at ECU I study the toxicological effects of PFAS, specifically, how they affect the immune system.

The immune system likely is on the minds of most Americans due to the COVID-19 pandemic as the immune system helps to protect us from pathogens like COVID-19 when it is working the way that it should. That's why it's especially concerning that an undesirable health effect of PFAS exposure documented in studies of people living in PFAS-contaminated communities and in studies of experimental animals is a depressed response to vaccines. This suppression of the immune system means that those who carry the burden of PFAS exposure may also be at increased risk from a COVID-19 infection, an increased risk of a more severe infection, and an increased risk of having a weakened response to the COVID-19 vaccine. One member of the military community affiliated with Pease Air Force Base recently noted that the "global pandemic is scary for everyone and it's even scarier knowing your family has been exposed to chemicals that may hurt the immune system when it's needed most."[1] This is one person among many who live in PFAS-polluted communities, communities in proximity to military bases and installations where PFAS were used and where PFAS now contaminate sources of drinking water. This also is one person among many who is worried about her health, the health of her family, and the health of her community from their PFAS exposure.

PFAS are a class of highly stable, heat and chemical resistant chemicals that are versatile in manufacturing processes and consumer and military goods such as aqueous film forming foams (AFFFs)[2]. PFAS are extremely long-lived in the environment and our bodies because they do not

[1] DeWitt J, Brown P, Carignan C, Kasper S, Schaider L, Osimo C, Fitzstevens M. Op-ed: PFAS chemicals – the other immune system threat. https://www.ehn.org/pfas-and-immune-system-2646344962/particle-1.
[2] 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.

readily break down, earning them the nickname "forever chemicals." The vast majority of PFAS are persistent and there are few options for efficient and cost-effective remediation. The current solution for PFAS that contaminate drinking water is to filter, capture, and transport to another location. PFAS filtered out of drinking water with carbon filters, for example, 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, leading to continued exposure. This is part of the dilemma that people living near military sites with known or suspected PFAS contamination from AFFF face. A recent report indicated that over 700 military sites may be contaminated with PFAS from AFFF uses at these sites; these DOD facilities have some of the highest PFAS detections, likely due to repeated AFFF use in training[4]. Often the costs of drinking water cleanup are born by taxpayers through rate increases by their water utilities or by personal income spent on in-home filtration units. One key part of the solution would be a major increase in cleanup funding for DOD so that they can quickly clean up the most contaminated sites. Confirming the presence of PFAS across all DOD facilities is also an instrumental piece of information needed to facilitate and prioritize cleanup efforts to the most contaminated sites.

The scientific evidence for PFOA and PFOS, including evidence from studies of people and from studies of experimental animals, strongly indicate that these PFAS are hazardous to the immune system. The immune system is a sensitive target of PFAS and data demonstrating suppression of the immune system have been used to establish maximum contaminant levels (MCLs) in drinking water for PFOS, for example, in six different states[5]. These state-level MCLs for PFOS are based on "reference doses," which are exposure concentrations that are not anticipated to be associated with adverse health outcomes across a lifetime of exposure, that range from 1.8 to 3 ng/kg/day. These state-level reference doses are an order of magnitude lower

[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.
[4] Press Release, UPDATE: Toxic 'Forever Chemicals' Likely Contaminate More Than 700 Military Sites, Environmental Working Group (Sept. 16, 2020), https://www.ewg.org/release/update-toxic-forever-chemicals-likely-contaminate-more-700-military-sites.
[5] Post GB. 2021. Recent US state and federal drinking water guidelines for per- and polyfluoroalkyl substances. *Environmental Toxicology & Chemistry*.; 40:550-563.

than the current US EPA reference dose for PFOS of 20 ng/kg/day based on developmental toxicity[6]. Several years ago, the US EPA established a now outdated and under protective lifetime health advisory level (LHA) of 70 parts per trillion (ppt) for PFOS based on developmental toxicity[7]. If these lower state-derived reference doses for effects on the immune system are used, the LHA for PFOS in drinking water would be ~7-11 ppt, or ~85-90% lower than the current US EPA LHA. This is just for PFOS, only one of the thousands of PFAS that are now known to exist. Latest estimates by the US EPA put the total number of PFAS at close to 10,000 individual compounds[8]. Cleanup efforts at PFAS-contaminated facilities should meet these state MCLs as they reflect the best science about PFAS-induced immune system harm.

In 2020 I published a paper with colleagues that concerned a study of an AFFF formulation[9]. This formulation was primarily 3M LightWater AFFF mixed with some fluorotelomer-based AFFFs and was collected from a holding tank at a contaminated field site. Our study highlighted two important factors of this AFFF sample: First, AFFFs contain novel PFAS and second, some of these novel PFAS may contribute to human exposures. In other words, focusing on PFOA and PFOS alone will likely underestimate the number of PFAS to which people in military communities are exposed; the PFAS problem is much more complex than just one or two compounds. One solution to this complex problem would involve management of PFAS as a single chemical class. This approach is based on scientific evidence that "the high persistence, accumulation potential, and/or hazards (known and potential) of PFAS studied to date warrant treating all PFAS as a single class[10]. This approach could apply to cleanup efforts that would remove all PFAS from drinking water, for example, as well as to the establishment of health protective measures across the class rather than to one PFAS at a time[11].

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[6] *Id.*
[7] US EPA. 2016. Fact Sheet: PFOA & PFOS Drinking Water Health Advisories. https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf.
[8] US EPA. 2021. PFAS master list of PFAS substances (Version 2). https://comptox.epa.gov/dashboard/chemical_lists/pfasmaster.
[9] McDonough CA, Choyke S, Ferguson PL, DeWitt JC, Higgins CP. Bioaccumulation of novel per- and polyfluoroalkyl substances in mice dosed with an aqueous film-forming foam. *Environmental Science & Technology*. 54:5700-5709.
[10] Kwiatkowski CF, et al. 2020. Scientific basis for managing PFAS as a chemical class. *Environmental Science & Technology Letters*. https://dx.doi.org/10.1021/acs.estlett.0c00255.
[11] Id.

A civilian firefighter at a US military base reached out to me a few years ago as he had seen and heard conflicting information about potential health risks of PFAS. From his base safety officer, he heard that PFAS were nothing to worry about, that they were no more of a threat to his health than bubble bath. But elsewhere, he heard otherwise, that PFAS did pose risks to his health and to the health of other firefighters, both civilian and military. I recently spoke to a former Air Force firefighter, who had been told by his military leaders that AFFF was no worse than soap and water, that it was nothing that he needed to worry about. Now he wonders if his health problems and those of his fellow Veteran firefighters are from their AFFF exposure. This indicates that DOD, for example, should do a better job of communicating the health risks of PFAS to service members, Veterans, and defense communities. I've also interacted with the wife of a firefighter who is leading efforts to disseminate evidence that PFAS are a component of the turnout gear that firefighters wear to protect them from the hazards inherent in their jobs even though they've been told that the PFAS in turnout gear is again, nothing to worry about. The PFAS in turnout gear can be shed from the gear, creating yet another source of PFAS exposure to firefighters[12] as well as another contributor to their health risks from PFAS.

While our scientific understanding of undesirable health effects of PFAS is still growing, concerted efforts among researchers is creating a baseline of health effects by which we can compare other PFAS. A comprehensive evaluation of the toxicological data for 14 PFAS compiled by the Agency for Toxic Substances and Disease Registry[13] reported a wide variety of undesirable health effects in people exposed because they work with PFAS, live in areas with high levels of PFAS in the environment, or even from everyday activities. These health effects include effects on the liver, the cardiovascular, endocrine, immune, and reproductive systems, and on development. Some populations have seen increases in kidney and testicular cancer. These undesirable health effects also have been observed in experimental animals exposed to individual PFAS through food, water, or skin, which are supportive of these findings of undesirable health effects in humans. These health effects are being seen at levels lower than the US EPA LHA of 70 ppt, which we now know is not health protective for all Americans.

[12] Peaslee GF, et al. 2020. Another pathway for firefighter exposure to per- and polyfluoroalkyl substances: Firefighter textiles. *Environmental Science & Technology Letters.* 7:594-599.
[13] 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.

Legacy AFFF formulations that relied on PFOS and PFOA have been phased out of use; however, replacement PFAS have stepped in. We need to learn more about these replacement PFAS, find out about data that already exists but are not yet part of the published literature, and ask ourselves, are these PFAS essential for the public good or are they just regrettable substitutes? We also have to consider costs of inaction with respect to PFAS. A recent report to the Nordic Council of Ministers estimated annual health-related costs of approximately $58-94 billion USD at current exchange rates for the European Economic Area countries[14]. Replacement PFAS are still persistent and have enhanced mobility and solubility that will lead to increased human exposures. Continual exposure to these persistent PFAS may increase the risk of undesirable health effects. These health effects may lead to health-related costs that will eventually be shouldered by public authorities and taxpayers[14]. We need to take action now that will help our country avoid these catastrophic health-related costs from PFAS. Congress should not wait any longer to address these very real health risks that PFAS pose to military personnel, military communities, and other communities contaminated by PFAS. We need a major ramping up of funding for DOD to clean up the hundreds of known and suspected PFAS contamination sites, and to find safe means of destruction of PFAS. We shouldn't be burning PFAS waste; we need to know how we can safely destroy them so we're not spreading PFAS throughout communities by sending them up smokestacks after incomplete combustion. Moreover, veterans and taxpayers should not have to shoulder the burden of PFAS exposure and costs of cleanup should not fall to taxpayers alone. Some solutions include cleaning up pollution from the use of legacy AFFFs, phasing out AFFFs that contain fluorine, phasing PFAS out of turnout gear, phasing out all non-essential uses of PFAS[15], and managing PFAS as a single class of chemicals.

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[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

[15] 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.* 21:1803-1815.

Appendix

Brief Summary of PFAS

The vast majority of chemicals within the class of per- and polyfluoroalkyl substances (PFAS) are persistent to degradation; they aren't readily or easily broken down by sunlight, microbes, or other natural 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. As a result, PFAS often are called "forever chemicals." In addition, many PFAS are highly mobile once released to the environment, which means that they can travel from points of release to points distant. PFAS have been found everywhere scientists have looked, from the Arctic Circle to umbilical cord blood connecting mothers with their developing babies.

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 ways in which 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 persistent 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.

Although scientists have studied only a handful of the nearly 10,000 compounds in the PFAS class, undesirable health effects have been uncovered for these PFAS, which include perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). Once in our bodies, these PFAS and others that have been studied interact with a wide range of molecules and biological systems to produce multiple types of these undesirable health effects. Studies of humans exposed because they work with these and other PFAS, live in areas of that have high levels of these and other 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 persistent 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 undesirable health effects in humans and wildlife.

Phasing out some of the PFAS, PFOA, 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.