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Committee on Environment
and Public Works

Subcommittee on Chemical Safety, Waste Management,
Environmental Justice, and Regulatory Oversight

Washington, D.C.

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EXAMINING THE PUBLIC HEALTH IMPACTS OF PFAS EXPOSURE

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The subcommittee met, pursuant to notice, at 9:34 a.m. in room 406, Dirksen Senate Office Building, the Honorable Jeff Merkley [chairman of the subcommittee] presiding.

Present: Senators Merkley, Mullin, Carper, Markey, Wicker.

STATEMENT OF THE HONORABLE JEFF MERKLEY, A UNITED STATES SENATOR
FROM THE STATE OF OREGON

Senator Merkley. Good morning, and welcome. This hearing of the Environment and Public Works Subcommittee on Chemical Safety, Waste Management, Environmental Justice and Regulatory Oversight is now underway. The topic is Everyday Exposure: Examining PFAS Pollution and its Impacts on Human Health.

In 1980, when President Carter signed the Superfund into law, he said we had created in this Country great prosperity and a leadership of the entire world with our chemical industry and with the energy industries. But we have neglected to pay part of the cost of that development, and now, of course, we must face that responsibility.

Today, we are here to discuss facing that responsibility, to understand the class of chemicals known as PFAS. Many folks know of PFAS chemicals from brands such as Teflon and Scotch Guard. But there are estimated to be thousands of PFAS chemicals in the use to resist water, stains, and grease. Some of these products include frying pans, furniture, food packaging, work boots, rain coats, microwave popcorn bags, pizza boxes, shampoos, cosmetics, contact lenses, toilet paper, firefighting foam, and the list goes on and on.

In other words, it is impossible to avoid PFAS. The chemicals are so useful for consumer products, because they are

durable and they are resistant to typical environmental processes including by water and bacteria. But those very qualities make them an environmental disaster. After decades of use, scientists are finding forever chemicals everywhere.

Rubbing salt into the wound, they are concentrated into biosolids generated by wastewater treatment facilities and subsequently spread on crops as fertilizer, putting PFAS back into the water and food we consume.

The more we learn about various PFAS chemicals, the clearer it becomes that any level of exposure is significant and dangerous. Estimates are that at least 45 percent of U.S. household tap water contains one or more PFAS chemicals.

Two of the best understood PFAS chemicals, PFOA and PFOS, the Environmental Protection Agency has concluded there is no safe level in drinking water. PFAS has been linked to devastating health problems, breast cancer, testicular cancer, liver damage, thyroid disease, colitis, fertility problems, high blood pressure, low birth weight, developmental delays, high cholesterol. So this is a public health challenge, and we want to understand it better.

These chemicals were first developed in the 1940s. By the 1960s, manufacturers like 3M and DuPont knew their products were toxic. In fact, in 1981, DuPont removed female employees from working with PFAS chemicals after eight women gave birth to

babies with severe birth defects. But these corporations kept these dangers secret for decades. The public didn't learn about them until they were revealed by a landmark lawsuit in the 1990s. PFAS manufacturers only began phasing out PFAS chemicals in the 2000s after public outcry.

Today, scientists and researchers are revealing the dangers of these chemicals, underscoring the necessary ubiquity of their use, and identifying pollution hotspots that need to be contained or cleaned up. But we need extensive monitoring data to understand the scope, the severity, and the urgency of the problem, and understand how Congress and Federal agencies can protect the public from exposure to these chemicals. Avoiding PFAS poisoning cannot and should not be the responsibility of individual consumers.

Thankfully, we have a panel of experts to help us understand this problem here today. Dr. Laurel Schaider is a senior scientist at the Silent Spring Institute, where she works to understand the health effects of PFAS exposure. As a result of her research, in 2022, New York State banned PFAS in food packaging, including pizza boxes, pastry boxes, sandwich wrappers, soup cups, and more. Since then, similar bans have passed in 12 more States.

Joining her is Dr. Sue Fenton from North Carolina State University, who specializes in understanding how disease

develops from PFAS. Her research is among the most cited toxicology work on PFAS exposure, and she was the first to identify how PFAS affects breast feeding. She previously worked for the Environmental Protection Agency and the National Institute of Environmental Health Sciences at the National Institutes of Health.

And we are joined by Michael Larrañaga, President and Managing Principal of R.E.M. Risk Consultants. He served on the Board of Scientific Counselors for the National Institute of Occupational Safety and Health, and a member of First Responders Advisory Group for the Department of Homeland Security.

Thank you all for being here to share your expertise today. Now I would like to turn this over to our Ranking Member, Senator Mullin.

[The prepared statement of Senator Merkley follows:]

STATEMENT OF THE HONORABLE MARKWAYNE MULLIN, A UNITED STATES
SENATOR FROM THE STATE OF OKLAHOMA

Senator Mullin. Thank you, Mr. Chairman. And thank you to all of our witnesses here. Thank you for your time, and I do appreciate your expertise.

I would like to thank first of course the committee that spent a lot of time doing this. A lot of times we get the credit, but we really know it is the staff that is doing most of the work, right?

I would also like to take the opportunity to introduce and welcome Dr. Larrañaga, who received his undergraduate degree from Oklahoma State University. I have to put a plug there, I have a couple of boys going to school right there, and wrestling. Of course, I also have one at OSU wrestling, too, so I am kind of house divided there.

He also later served as department head of the School for Fire Protection Safety. Almost everyone at some point in the past few years has heard about PFAS, unless you live underneath a rock, which is okay, because likely you would be in a lot better mental health if you did. For those who have not heard of PFAS, those acronyms refer to a group of chemicals first discovered almost 90 years ago that provided immense durability, strength and resilience, which is why PFAS is so commonly used in manufacturing markets today.

Several thousands of PFAS have been manufactured and are used in a variety of industries around the world, including electric vehicle batteries, military and civilian aerospace equipment, semiconductors, linings for piping, surgically implanted medical devices, inhalers, water filtrations, foam touch streams, which all of us use today, solar panels, coatings for steel and concrete bridges, and you name it, they are pretty much involved in it.

So, with so many different types of PFAS used in so many applications, blanket banning PFAS without fully understanding the risks, the differences between the chemicals, would not only suffocate our economy, it would halt innovation. But it would also disproportionately impact low-income and rural communities who already face many other challenges.

One thing I want to make clear is that although it is not nearly as impossible to show that all PFAS directly causes negative health conditions in humans, several studies have shown that significant exposures to certain PFAS can cause adverse health effects. However, as Congress considers PFAS regulations, we must also work to avoid unintentionally harming technological advancements and national security.

I will pause here for a second and say, one thing that Congress seems to do is we overreact. I want to get it right. I live and walk in this world just like everybody else. I have

six kids that are growing up in this world. And I expect to be around for a long time and I want my kids to be around and I want my grandkids to be around. So overreaction is not what I want to do here.

But looking for a direction, a healthy direction, and moving in the right path is why you guys are here today. Hopefully you can incite wisdom, leave emotion out of it and put facts in place. And you can help steer us in the right direction.

So once again, thank you for your time. With that, Mr. Chairman, I will yield back.

[The prepared statement of Senator Mullin follows:]

Senator Merkley. Now I would like to turn this over to the Chairman of the entire committee, Senator Carper, and I believe this may be his last hearing.

Senator Carper. Don't say that.

[Laughter.]

Senator Carper. Saving the best for last.

Senator Merkley. Your last hearing while serving as Chair, and we are delighted to have you here.

STATEMENT OF THE HONORABLE THOMAS R. CARPER, A UNITED STATES
SENATOR FROM THE STATE OF DELAWARE

Senator Carper. Thank you. It is wonderful to serve with you and our colleagues on this subcommittee.

One of the things we get to do as we come to the end of our tenure in the Senate, we get to give a farewell address. Later this week, actually next week, I have the opportunity, a week or so from today, to give a farewell address. I am going to talk for three hours about PFAS that day. Not really.

But I am going to talk a bit next week when I give my farewell address about all that we have accomplished in this room with this committee, with the involvement of the two gentlemen to my right. There are a couple of big issues that we have not been able to resolve. One of those is before us here today.

I like to say, the key to success in life is you just don't give up, never give up. This is an important issue; it is an important issue for us to find common ground and something that is fair and reasonable, but actually provides the protection that we need.

So I am delighted that the last hearing is on one of the toughest issues that we face. I would just urge both of you to make sure that in the next Congress, we don't quit, we find a way to yes. Thanks so much.

[The prepared statement of Senator Carper follows:]

Senator Merkley. Thank you very much, Chair Carper.

We will now turn to our witnesses' testimony, starting with Dr. Laurel Schaider.

STATEMENT OF LAUREL SCHAIDER, PH.D., SENIOR SCIENTIST,
ENVIRONMENTAL CHEMISTRY AND ENGINEERING, SILENT SPRING INSTITUTE

Ms. Schaider. Good morning, Chairman Merkley, Ranking Member Mullin, and members of the committee. My name is Laurel Schaider. I am a senior scientist at Silent Spring Institute, an independent non-profit research organization investigating links between everyday chemicals and health. We are leaders in researching women's health and breast cancer prevention.

Since 2009, I have led research on how PFAS moves through the environment, how people are exposed and how these chemicals affect our health. Thank you for the invitation to testify today.

PFAS, or forever chemicals, have polluted every corner of the globe. They have been found in the blood of nearly every single American whose blood has been tested. My colleague, Dr. Fenton, will tell you about the many serious health effects associated with PFAS. I am here to tell you why that is very bad news.

Exposures to PFAS are widespread. They are in our water, our food, consumer products, even in the air and dust in our homes. Although all of us have PFAS in our bodies, some communities and individuals have much higher levels than others.

My main point is this: we need comprehensive strategies to address PFAS contamination, identify and reduce exposures,

support impacted communities, and ultimately eliminate unnecessary uses of these harmful communities.

PFAS are used in a wide range of everyday products, like non-stick cookware, stain resistant carpets, and cosmetics. My own research has shown that PFAS are widespread in food packaging and consumer products, like dental floss and children's clothing and furnishings. We have shown that PFAS can migrate out of products and end up in our bodies.

Infants can be highly exposed, since PFAS can cross the placenta and contaminate breast milk. PFAS have also contaminated our environment. Millions of people in the U.S. are drinking tap water containing PFAS, according to testing by the U.S. Geological Survey in 2023.

The most severe contamination is found near industrial facilities and military bases, airports and other locations where aqueous film forming foam, or AFFF, was used. In many other communities, PFAS contamination comes from wastewater treatment plants, landfills, septic systems, and sewage sludge used to fertilize farm land.

Earlier this year, the EPA set standards for six PFAS in drinking water. These standards were set in the low parts per trillion range, much lower than for most other contaminants, underscoring their extreme toxicity. These new standards will go a long way to reducing exposures.

However, they only apply to six individual PFAS, a drop in the bucket compared to the more than 14,000 chemicals classified as PFAS. And they do not protect the 44 million Americans who rely on a private well for their drinking water.

The health and economic costs of PFAS are not evenly distributed. Public water systems serving small communities, particularly in rural areas, need more financial and technical support for testing and treatment. Our research has found that communities with higher proportions of Hispanic and Black residents are more likely to be exposed to PFAS through their drinking water. And PFAS can build up in fish and shellfish, so tribal communities and subsistence fishers may be especially vulnerable.

PFAS contamination takes a toll on communities. I have heard from anguished parents who feel guilt for having unwittingly exposed their children during pregnancy and breast feeding. I have heard from farmers who have lost their livelihood because their land and livestock were contaminated.

And I have heard from too many people who have lost loved ones to cancer or other diseases that they suspect were caused by PFAS. They face a lifetime of worry about long-term health effects.

Our health care systems have not caught up with this public health crisis. We need better access to PFAS blood testing, as

recommended by a 2022 National Academies report. We need more resources to educate clinicians, such as those developed by our NIH-funded PFAS-REACH study as models for how PFAS blood testing can improve clinical care. New Hampshire now requires insurers to cover the cost of PFAS blood tests, and similar policies are needed nationwide.

To protect public health and the environment, we need to turn off the tap on unnecessary uses of PFAS and develop safer alternatives. Many everyday uses of PFAS are not essential. PFAS in products such as cosmetics, dental floss, and home textiles have no real health or safety benefit. For some other uses, like firefighting foam, safe and effective alternatives already exist.

In 2019, an international panel of experts from the fire engineering industry concluded that fluorine-free foams, which don't contain PFAS, meet the same performance standards as AFFF without long-term pollution risks.

We will never solve this problem if we attempt to address PFAS one at a time. We need comprehensive strategies to address all PFAS, including fluorinated polymers as a class. Production of PFAS can expose workers and nearby communities, and products containing PFAS can contaminate the environment after their disposal.

We need to stop assuming that chemicals are innocent until

proven guilty. We are still dealing with costly messes from chemicals manufactured years ago, like DDT and PCBs. Fortunately, we also know that legislation can lead to significant improvements, like substantial declines in children's blood lead levels, and recovery of bald eagles from DDT in recent decades.

We need to act now to address the current PFAS contamination crisis, prevent additional contamination, and protect future generations.

Thank you.

[The prepared statement of Ms. Schaidler follows:]

Senator Merkley. Thank you very much, Doctor.

Now we will turn to Dr. Fenton. Thank you.

STATEMENT OF SUE FENTON, PH.D., DIRECTOR OF THE CENTER FOR HUMAN HEALTH AND THE ENVIRONMENT, PROFESSOR OF BIOLOGICAL SCIENCES, NORTH CAROLINA STATE UNIVERSITY

Ms. Fenton. Good morning, Chairman Merkley, Ranking Member Mullin, Chairman Carper. I am honored to be here for your last round.

Two decades ago, my EPA colleagues and I discovered that newborn mice exposed to PFOA during pregnancy were dying. PFOA caused a dose-dependent decrease in birth weight of mouse pups. But even those that appeared healthy at birth died several days later.

We reported a few years later, for the first time, that PFOA caused deficits in lactation, was transferred across the mouse placenta, was present in the breast milk of mice and women exposed to PFAS, and induced obesity and persistent breast developmental abnormalities during puberty from just a pregnancy exposure.

Around that same time, PFAS and PFOA were voluntarily phased out of the market by the manufacturers. But by then, most Americans had it in their blood. Most of us here today, and I have looked at the room, have been exposed to PFAS as young adults. But a lot of the people sitting behind me were exposed in utero. They may have received up to 40 percent of their mom's body burden of PFAS.

Today, it is likely that all U.S. children are born with a PFAS body burden and we have evidence of that from the CDC testing that is shown in Figure 1 on the screen. For several reasons, children are more vulnerable to the effects of PFAS than adults. Body burdens in children are higher, because they are breast fed. In America, human breast milk levels of PFAS and PFOA are at or above ATSDR's children drinking water screening level for these PFAS.

We don't have a crystal ball to predict the severity of the health effects for this prenatally exposed generation. But scientists like myself are very concerned.

In general, health effects associated with PFAS exposure include many of the things that Senator Merkley described in his opening remarks, and are really nicely summarized in the two documents that I have provided to the committee in your documents, the PFAS report to Congress and a highly cited paper by myself and other PFAS experts.

Senator Merkley. Without objection, we will have those entered into the record. Thank you.

[The referenced information follows:]

Ms. Fenton. Although pregnant women and children are more vulnerable to the effects of PFAS, the 2022 National Academy report only provided clinical guidance for adults. Many new papers have emerged since this guidance was published, including alarming data indicating increased risks of fatty liver disease in children associated with PFAS exposure. Children don't usually have fatty liver disease.

Due to the shorter half life in humans and rodents, GenX was offered by industry as a safer alternative to PFOA. However, my own studies in pregnant mice exposed to equivalent doses of PFOA and GenX finds they have similar health effects, especially fatty liver disease and metabolic disease. Therefore, GenX is not a safer alternative for PFOA.

These toxicities in studies are super important for the people living in contaminated counties of North Carolina who were exposed to GenX in their drinking water and other perchloro ethers for decades. They will likely suffer health effects later in their life.

NC State faculty are engaged with these communities and their families, and they deserve to be followed for health effects, just like the science panel study on the health effects of PFOA many years ago.

Today, women of reproductive age were born between approximately 1992 and 2004, when PFAS and PFOA were at their

highest levels in human blood. So the body burdens of these legacy chemicals are high. But these women, of the age that are in this room, are also exposed to emerging chemicals that we know very little about. We can't wait 20 more years to determine the health effects of PFAS exposures that are currently being passed from one generation to the next.

Ongoing studies at federally funded labs across the U.S. are evaluating the effects of replacement PFAS, comparing those to known effects of legacy PFAS. While many studies can be done, we know enough today to say that replacement PFAS are not safe replacements.

I ask this committee to promote the following suggestions to protect public health. Develop new and support current legislation to limit PFAS production and use as much as possible. Require health insurance companies to pay for PFAS testing for susceptible populations, like tribal communities, pregnant women and children.

Empower the National Academy to update clinical guidance on PFAS to include children and pregnant women. Commit NIEHS and NC Cancer Moon Shot funds to develop a longitudinal health study on replacement PFAS exposure communities, especially those that may have been prenatally exposed. Oppose efforts to weaken CERCLA.

Phase out PFAS-containing fire foam. Require companies to

provide standards in any purified forms of any PFAS they produce. Fund innovative developmental methods to remove replacement PFAS from drinking water. And require PFAS producers and not taxpayers to fund the development of safe destruction methods that fully capture, mineralize and destroy PFAS.

Please continue to move forward with our efforts to keep PFAS out of our environment. Remember, once it gets there, it takes billions of dollars and decades or generations to get rid of it. Our taxpayer dollars can go to better purposes than PFAS cleanup stemming from lucrative industries.

I do want to say that the current rules that are in place are really a win-win. They are not only removing PFAS, but they are also removing other contaminants that are commingled.

I want to thank you for your time and your influence.

[The prepared statement of Ms. Fenton follows:]

Senator Merkley. Thank you very much.

I am going to defer to Senator Carper.

Senator Carper. Thanks so much. I will just take another minute, if I could. There are a number of other committees that are meeting right now, with hearings. It is not like they are postponing everything until the last day or the last week, there is just a lot of important stuff that we need to be dealing with. This is certainly one of them. I am going to slip off to be at my other committee and try to participate in those hearings.

The words of my father, as I sit here, come back to mind. My dad used to say the hardest things to do are sometimes the most important things to do. This is a hard thing to do, but it is also a really important one. My mother used to say, if you think you can, or you think you can't, you are right. If you think you can or you think you can't, you are right.

A couple of years ago, at a hearing right here in this room, sitting, Michael, where you are sitting, was a fellow named Rob Wallace, a close friend of Senator John Barrasso from Wyoming. He was here for a hearing. He had been nominated by Donald Trump for a senior position in the Department of Interior. Rob Wallace said to us that day in his testimony, the bipartisan solutions are lasting solutions. Bipartisan solutions are lasting solutions.

So I would just say, as I prepare to weigh anchor and set sail into the sunrise in a week or so that I hope that Senator Mullin, you and Chairman Merkley can somehow do what the rest of us have been unable to do, and that is to come to the right solution here. If you think you can or you think you can't, you are right. And I think you can.

Thank you all very much.

Senator Merkley. Senator Carper, thank you for the many quotes you have instilled in our minds. That is certainly one of them: if you think you can or you think you can't, you are right. Another is, it is not that hard, just do more of what works and less of what doesn't.

Senator Carper. Find out what works and do more of that. There you go.

Senator Merkley. And if you want to go fast, go alone. If you want to go far, go together. So thank you for these words of wisdom over the years.

Senator Carper. I will be gone but not forgotten. That is a plus.

Senator Merkley. That is right.

Dr. Larrañaga, welcome.

STATEMENT OF MICHAEL D. LARRAÑAGA, PH.D., P.E., PRESIDENT AND
MANAGING PRINCIPAL, R.E.M. RISK CONSULTANTS

Mr. Larrañaga. Thank you, Chairman Merkley, Ranking Member Mullin, and Chairman Carper.

I am testifying here today on behalf of the American Industrial Hygiene Association, the association for scientist professionals committed to preserving occupational and environmental health in the workplace and community.

One of the headlines I want you to remember from my testimony today is that the use of PFAS chemicals is vital to the critical infrastructure of the United States. We must manage these chemicals responsibly and balance their use against the risk of using proposed alternatives.

The use of PFAS is indeed critical, not only in the sense that our critical infrastructure provides a backbone for the U.S. Government to ensure our security, but also in the sense that our critical infrastructure is vital to maintaining the American way of life. For example, PFAS as described earlier in this hearing are used in the manufacture of semiconductors and electronics, medical equipment, pharmaceuticals, herbicides, insecticides, plastics, airplanes, automobiles, buildings, and thousands of other applications that we rely on every day.

One aspect of my job is to assist companies in identifying alternatives for PFAS-containing firefighting foams. This is no

easy task, as the PFAS containing aqueous film forming foam, or AFFF, is by far the best firefighting foam available. Companies are spending millions of dollars, sometimes per facility, to transition away from AFFF to fluorine-free foams. And the U.S. Government is doing the same.

Our critical infrastructure stakeholders are replacing their AFFF fire suppression systems at great cost with less capable fluorine-free foams. It is important to note that the historical legacy AFFF foams using long-chain PFAS, you may have heard of these as CA foams, are no longer produced, sold or imported into the United States. We as a country are no longer recklessly disposing of mass volumes of chemicals containing PFAS directly into the environment.

Modern AFFF formulations that meet the 2019 military specification contain trace amounts of PFOA or PFOS. Just to put that into perspective, the 2019 Intercontinental Terminals Fire in Deer Park, Texas, released 132, almost 133 pounds of air emissions per hour during the first 24 hours, eventually releasing more than 16 million pounds of toxic air emissions. Responding fire departments attempted to extinguish the fire with fluorine-free foams, and the fire burned for 51 hours.

During the 51st hour, PFAS-containing AFFF was applied, and the fire was extinguished 13 hours later. During those 13 hours of AFFF application, the use of the modern military spec AFFF

foam would have resulted in about 30 ounces of PFOA or PFOS introduced into the environment, or about two and a half of these coffee cups.

So the risk versus reward calculation here is this: is it better for the environment and surrounding communities to be exposed to 16 million pounds of toxic air emissions, which is 30 ounces of PFOA or PFOS? Had MilSpec AFFF been applied initially, the fire would have likely only burned for a couple of hours, if that, and we could have avoided releasing millions of pounds of toxic emissions into the air, most likely with a couple of ounces of long-chain PFAS released.

According to Dwight Williams of the industrial firefighting team that extinguished the fire, the fire could not have been extinguished without the use of AFFF. In addition, there were 51 hours of fluorine-free foam application and fluorine-free foams are not without their own toxicological drawbacks, being more toxic to certain types of aquatic life than AFFF.

Another examples is the chemical fire in Rockton, Illinois. It was brought under control in three hours with the use of AFFF, when officials required the fire department to stop the application of AFFF for environmental concerns. The chemical fire then burned for another eight and a half days, generating 21 million pounds of air emissions which could have been avoided.

The fluorine-free foams are simply not as effective at attacking complex fires that occur in industrial facilities, onboard ships, or during an airplane crash, for that matter. Major airports are transitioning away from AFFF to fluorine-free foams, and the Department of Defense is doing the same in all but the most critical applications.

I am sitting here today to tell you that if my family and I are aboard a jetliner that crashes, please soak us in AFFF. Why? Because jetliner fires are dangerous. Fire moves exceedingly fast and AFFF is simply superior at putting out fires.

It is important to recognize that AIHA and I recognize the toxicological properties inherent in these PFAS, and in no way encourages the improper use or disposal. AIHA supports the responsible management of these chemicals. However, we recommended a balanced and commonsense approach to chemical management and regulation, whereby the implementation of the risk versus reward calculus includes the assessment of the consequences of requiring the use of alternatives, removing these chemicals from the marketplace, and regulating these chemicals as an entire class instead of health and risk-based frameworks.

In summary, the use of PFAS chemicals is vital to the critical infrastructure of the United States. We must manage

these chemicals responsibly and balance their use against the risk of alternatives.

On behalf of myself and the AIHA, thank you all for the opportunity to provide feedback on this important topics.

[The prepared statement of Mr. Larrañaga follows:]

Senator Merkley. We are delighted to have you share that information on foam, and I almost feel like we need a separate hearing to examine the complexities of the risk-reward that you have referred to.

Today, we are primarily focused on consumer products that people come in contact with. I want to start simply by, when a lot of people hear about PFAS, they hear Teflon. The most common thing in our homes that has Teflon, as far as I am aware, are no-stick pans like this one. Is it correct, I will direct this to you, Dr. Schaider, is this PFAS? And is this a simple case of, we could just simply retire these pans? Does some of this forever non-stick Teflon get into our blood and our children's blood when we use these pans?

Ms. Schaider. Thank you, Senator, for the question. Yes, there are still frying pans that are made with Teflon. Teflon is a long polymer, PFAS. In the production of Teflon, smaller PFAS molecules are used and put together to make the long polymers and other PFAS are used as processing aids.

So frying pans are what I would consider a non-essential use of PFAS. We certainly have other ways to make cookware without the use of these toxic chemicals for everyday uses. There are concerns about PFAS exposures through the use of cookware, because the smaller PFAS molecules can come off of that cookware and expose people. There are also concerns about

the life cycle. So in communities where Teflon is manufactured, with local environmental contamination and exposures among workers. Then at the end of a product's useful life span, those PFAS ultimately can end up in landfills or emissions from incinerators.

Senator Merkley. So we have various agencies that evaluate the risk to our citizens of different products. If this is non-essential and it presents a health risk, why do we still have Teflon coated pans being sold to the public?

Ms. Schaider. I think that is a great question. I think because industry has been able to make the case that newer PFAS are less bio accumulative in peoples' bodies, that they are still acceptable to use. But I would argue that the newer replacement PFAS that are in use, as Dr. Fenton described, are not safe. And in cases like cookware, we should find alternatives to PFAS, because they are simply not an essential use.

Senator Merkley. Dr. Fenton, you referred in your testimony to GenX. People listening to that hear "Generation X." But that wasn't at all what you were referring to. You were referring to a chemical replacement. Can you explain a little bit about that?

Ms. Fenton. Sure, I would be happy to. I am talking about HFPO-DA. It is a dimer acid, affectionately called GenX. There

is more than one, multiple chemicals. The one thing really important about the GenX work that we have done is that when we saw the health effects in the animal studies that we have done, we couldn't measure it in their blood anymore. But we know we gave it to them.

So at early life stages, or right before birth, we know we could measure it in the blood of the animals. But the people living in the areas that have been affected by GenX for decades, you can't measure it in their blood either anymore. We know that if you are exposed, the health effects can still happen.

Senator Merkley. When you referred to the mice studies that you were looking at, those were PFAS studies. But there have been similar studies on GenX?

Ms. Fenton. Yes, there are, Jane Hoppin, for example, at NC State University, and others, are doing biomonitoring studies to look at many of the replacement PFAS that are known to be in the water in the Cape Fear River Basin, and have been there for decades, like I said.

Senator Merkley. Dr. Schaider, I have read in the past that microwave popcorn packages, like this one here, have non-stick surfaces, but that it's PFAS. Is that true? Is there PFAS in our microwave popcorn packages?

Ms. Schaider. Thank you for the question, Senator. Testing that Silent Spring Institute led in 2017 found that PFAS

are common, were common in fast food packaging. Other studies found that microwave popcorn bags also contained PFAS as a grease-proof agent.

In the meantime, some States have put in place bans on PFAS in food packaging. Then most recently, earlier this year, the FDA announced that PFAS are no longer allowed in paper food packaging as grease-proofing agents. So my understanding is that microwave popcorn and other paper-based food packaging should no longer have PFAS. I am not sure about imported food packaging, and how much testing and enforcement there is for imported food packaging.

Senator Merkley. So in these cases where PFAS has been replaced, what has it been replaced by, and is that equally dangerous?

Ms. Schaidler. In some cases, the solutions to PFAS in food packaging are a simple replacement. In our study of fast food packaging, we found about half of wrappers did contain PFAS and half did not. I would be happy to provide some additional information about what the replacement chemicals are.

But my understanding is that the replacements, other non-PFAS food additives would not be as persistent or pose the same health risks.

Senator Merkley. I have heard that paraffin, palm oil wax, and coconut wax are often used as a replacement for PFAS in food

packaging. Are those dangerous to our health?

Ms. Schaidler. Those would be safer alternatives than PFAS.

Senator Merkley. In the States that have -- I see I am over my initial time here. I am going to yield to my colleague, but we may have time to go through several rounds of questions.

Senator Mullin?

Senator Mullin. Thank you so much. It is not like we have a lot of people waiting in line, so I wasn't too worried about you going long on that. But I do appreciate you looking at the time.

Ma'am, we were talking about what is in food packaging, in the popcorn and the non-stick pans, which, the consumers are the ones who want to buy those pans, because cast iron is hard to deal with. For a guy that doesn't cook at all except Spam, I know how that sounds, but yes, I am the guy that likes Spam, okay? I am the one that buys that stuff, because it is the only thing I cook at my house up here in D.C.

I also want to bring to everybody's notice, it is also on all of our touch screens, right? PFAS is in everyone's. So by using our touch screens, by using our phones, which everybody here has, and every one of our schools are giving them out for, that is how they are doing their homework now and doing their work at school. Is this contaminating our kids, too, every time they use the phone, every time they do their work at school?

Ms. Schaider. Thank you for that question, Senator. I am not aware of studies that have looked at the extent of PFAS coming off of phones and touch screens. I wonder about that with my own children as well.

But I do worry about the potential for PFAS to come off of products and end up in people's bodies.

Senator Mullin. I bring that up because the pan, you are talking about the food, but the Teflon is designed to stay there. I mean, these, if you look at my phone, which you can't see, I don't even replace it every time I crack my phone, because I know I am going to drop it the next day. But it cracks up, we see them crack up, it is constantly on our head, it is constantly on our fingers, we are constantly using our fingers.

So I don't know how this isn't the same as using the pan. I mean, I am serious. If you are talking about contamination, how does it transfer from one place to the next if it is not transferring by touch? And I say that because we don't know. And so when we are moving forward to put a ban on PFAS, one, what are we going to replace it with? I don't think coconut wax is going to replace these touch screens, right?

When we start talking about insulating cups, I will leave the names out of them, but my kids drive me nuts with all these stupid insulating cups every time they get in my truck. It is

like some fad that they carry. And it drives me nuts. But everyone one of those insulated cups for the most part have PFAS in them, right?

Ms. Schaider. Yes.

Senator Mullin. So what is it, at what level do we stop, and what level is it contaminated, which level is it isn't? Is it just on the disposable side of it, that we are not disposing of it right?

These are questions that we need to talk about. Because it is something that we use in our everyday life that we have to be careful about. Yes, ma'am, go ahead.

Ms. Fenton. If I might, Senator Mullin, I want to suggest a couple of things here. Yes, these are all ways that we could be exposed. We do know that PFAS can be dermally absorbed, so, through your skin. Some can be dermally absorbed. They are water soluble. So they are going to go into your skin.

But this may not be the most prominent way that we are being exposed. I want to suggest that we do spend some time talking about PFAS in foods, foodstuffs, drinking water. Because those are major pathways of ingestion and exposure for all Americans.

So there are some new work coming out of East Carolina University and NC State showing that produce grown in our State is contaminated with PFAS, just because of the soil that they

are being grown in. Now, that is a shame. I hope that we can get to a place where we can get rid of the PFAS in the ground that the dairy cattle may eat the grass from that ground and our children could eat those blueberries.

But making sure we have clean drinking water and food that is not contaminated with PFAS is a really major win.

Senator Mullin. I would ask on, what exactly are we talking about with the health risks that it is exposing to? Because most of that which you are talking about, because plumbing is my background, and I also carry a C license, operating license for water treatment plants and wastewater treatment plants.

Most of it is delivered through the water system from irrigation. But what we actually don't know is what harm it is actually causing, what is the long-term effects. We are identifying PFAS as there, but it is like we are putting the cart before the horse. We are saying that it is there, so it must cause some type of issue.

But there is not enough study to actually say it is causing these issues. I just want to be cautious. I don't want to overreact. And I am not getting into all my questions, because I want to talk about semiconductors, too, sir, but I am running out of time. We will circle back on this.

The whole point I am trying to make right here is, we all

see that it is everywhere. It is everywhere. But I don't think we are even close to knowing the exact studies of if it is harmful and if it is, which direction is it harmful? At what point is it harmful? Is it just at the manufacturing stage? Is it in the raw form in itself? And so, yes, ma'am, you can finish, and I will go over my time.

Ms. Fenton. I actually have a good answer for that. Many of the PFAS that we are talking about today don't change form. So it would be whatever, the PFOA, for instance, if you are exposed to PFOA, that is what is in your blood, and that is what stays in your blood. It is not easily removed from the body.

We do know that many, a good handful of PFAS, we do know the health effects. I have put on the docket two really good reviews of the health effects of PFAS. One was written by Federal employees working across the entire base of the Federal Government, anybody who worked with anything with PFAS was on this committee that wrote the PFAS Report to Congress. Numerous health effects, both in humans and toxicology studies and ecology studies, are in there.

Also, some colleagues of mine wrote specific, targeted areas that have the biggest weight of evidence for health effects of PFAS. And those do include cancer, birth weight reduction of newborn infants. So specifically for the newborn infant issue --

Senator Mullin. I am sorry, I am almost two minutes over time. I apologize.

Ms. Fenton. So for the newborn infants, we can estimate the amount of decrease in their birth weight by the amount of increase in the PFAS in the mom's blood. There is a direct correlation.

Senator Mullin. I am over time. We will get back to you, we will circle back around.

Senator Merkley. We are going to turn to Senator Wicker.

Senator Wicker. Thank you very much. I am intrigued by the pronunciation of this substance. So since the last witness says PFAS, I will say PFAS. Some people say PFAS.

I want to nail something down, if I can. Is there a category of PFAS, and I will ask this to you, Dr. Larrañaga, that is not harmful as compared to a type of PFAS that is? And here is where I am going. There is a rather far-reaching definition of PFAS as "any compound containing at least one fully fluorinated carbon atom."

I am told by some people that this combines a type of PFAS that is okay, and not harmful, with a type that is. And that the type of PFAS that is not harmful is used in 95 percent of our ammunitions, and a number of very, very important things to our economy, not to include national defense. So if the panel, starting with Dr. Larrañaga, would discuss that, I would

appreciate it.

Mr. Larrañaga. Thank you, Senator. It is my understanding that the fluoropolymer substances like PTFE, for example, that is used in many of our defense systems, 95 percent of our ammunition has a similar type of polymer chemical, almost all of our weapons systems have these types of chemicals. And that the PFAS of concern did not come out of those, for bioavailability, so they aren't available to the body for absorption.

Senator Wicker. Although they do contain one fully fluorinated carbon atom?

Mr. Larrañaga. Yes, sir.

Senator Wicker. They do not propose, they do not comprise a harmful substance?

Mr. Larrañaga. That is correct. One of the issues is, that could be caused if you are heating them. If you are heating them far above the temperature that they are rated for, that could happen.

Senator Wicker. For example?

Mr. Larrañaga. For example, a pan. That is a complete use where we could remove that from the marketplace without any adverse effect to our infrastructure or defense.

Senator Wicker. Okay, so are we, should we be concerned that certain domestic suppliers will not be able to meet the demand for very important products as they continue to fight

over this definition?

Mr. Larrañaga. Yes, sir. If we were to ban as a country all PFAS chemicals with a broad brush, it would affect our supply chain that would lead directly to our military, public health, and all these critical infrastructure sectors. One example is the guidance systems on airplanes and ships and a lot of other drones and things like that use semiconductors that, in which PFAS was used to create those semiconductors. In addition, the wiring, the insulation on the wiring has PFAS-containing chemicals as insulators to the wiring.

If we were to broadly brush these into a regulator where we couldn't use them anymore, airplanes would have to get heavier, they would carry less people, they would carry less cargo, and they would become a lot heavier. So what that would mean is, we would be burning a lot more carbon to move the same amount of cargo or people.

Senator Wicker. And public health would not be any better off?

Mr. Larrañaga. Public health would not be better off, because you would be increasing the amount of air pollution that you put into the environment, which ends up in our oceans anyway.

Senator Wicker. Okay, well, let me ask, Mr. Chairman, to at this point enter into the record a report on critical per and

polyfluoroalkyl substance use.

Senator Merkley. Without objection.

[The referenced information follows:]

Senator Wicker. Thank you. If other members -- my time has expired but I am sure other members of the panel would like to respond.

Senator Merkley. I think that is an invitation, if anybody else wanted to follow up on his question.

Ms. Schaidler. Thank you for your question, Senator Wicker. To my knowledge, there are no PFAS that I would consider completely safe. Different PFAS have different chemical structures and different toxicity. We know a lot about PFOS, PFOA, and a handful of other PFAS chemicals that are frequently found in drinking water supplies, and in people's blood. There are newer PFAS replacement chemicals that are more mobile in the environment. We have been studying them for a shorter amount of time, but as Dr. Fenton said, they raise many of the same health concerns.

When we talk about fluorinated polymers, like PTFE, those are large molecules and they are less likely to enter our cells and may not have the same type of toxicity. As Dr. Larrañaga said, if you overheat those, though, they can produce toxic fumes. For instance, in your home, if you overheat a Teflon pan, those fumes can be really toxic for pet birds. I can't imagine that they are good for our health, either.

I would add another important point, though, that fluorinated polymers don't occur by themselves. Polymers are

produced from shorter PFAS chemicals that are stitched together, and products containing a fluorinated polymer also contain a mixture of different PFAS chemicals. So we never are exposed to just one PFAS at a time.

So even fluorinated polymers raise concerns about exposures among workers and fluoropolymer production facilities and in the communities, for instance, in North Carolina, that Dr. Fenton described, in the communities around those facilities where drinking water, soil, sediment can be contaminated.

Then at the end of a product's useful life span, there are concerns about disposal, what happens to those PFAS after we throw away products that contain PFAS. If they are incinerated, there are concerns about air emissions and what that might mean for communities around incinerators that are often environmental justice communities. Or putting them in a landfill could lead to slow release from landfills over time as well.

In terms of the different types of uses of PFAS, I would point to the essential uses framework, which I think provides a really nice path forward for identifying where we can start making reductions in PFAS use now. It is certainly easier to take PFAS out of a Teflon pan.

Another common use I would point to are dental flosses. Oral-B Glide dental floss, which is made with Teflon, we are putting Teflon in our mouth. To me that is a non-essential use

that we could absolutely do away with right now. If we are talking about critical infrastructure, cell phones, semiconductors, those might take longer to find alternatives to phase out their use.

Senator Wicker. That statement is very much appreciated, the last sentence.

It seems that I have mispronounced your name, Larrañaga?

Mr. Larrañaga. Yes, sir.

Senator Wicker. Okay, I have done better.

Mr. Larrañaga. Thank you. First of all, Teflon dental floss is absolutely necessary. My teeth are packed so tight that that is the only thing I can get in there.

[Laughter.]

Mr. Larrañaga. We agree that we shouldn't improperly dispose of PFAS-containing materials. But let me give you an example of how important PFAS chemicals are. The firefighting foams that we are replacing the PFAS-containing AFFF with contain fluorinated polymers.

So if we were to remove these chemicals from the marketplace with a broad brush, we would be left without the ability to fight these large fires, even if we have to fight them in a compromised fashion, because these new foams are not as effective as AFFF.

Ms. Fenton. Can I comment, please?

Senator Wicker, I read just last night a document from the Federal Aviation Administration that there are two MilSpec AFFF, they are on the QPL, right now. We do have safe replacements. I know at least they have listed two, and they were considering a third one.

So although it seems ominous, especially for the defense systems, some of the microcomputers, things like that, to replace something that seems essential, we are being successful at it. Someone, in fact, one of the companies that makes the QPL PFAS-free foam is a company that made AFFF foam. So they are doing it. They are still making money, they are still building their industry, and they are using their imagination and their experts to make a safer product.

So I do think it is doable, and it is happening already. I just want to leave you with that impression.

Senator Wicker. Thank you, Mr. Chairman, for that indulgence, and perhaps witnesses can supplement their answers for the record.

Senator Merkley. Thank you very much, Senator.

I want to go back to a point you made, Dr. Fenton, about understanding the major pathways of human contamination. There are probably plenty of places where PFAS is, and it may be the insulation on wires, that may have a very low impact on human health, especially if they are hidden behind a wall on an

aircraft.

But as I understand it, the main things you are identifying are PFAS that is in our food and in our water. On the food side, the mention was about biosolids, and what we are talking about is in the human waste that is then repurposed as fertilizer. So it is interesting that when some PFAS goes through our bodies and doesn't stay in our blood, it finds its way back into our food. And maybe the second time around, it has an impact.

So I really want to focus on those major sources of contamination that affects our health. You noted one aspect of that, studies that really focused on holding other factors constant. There is lower birth weight in humans who have a higher exposure to PFAS. I assume this is by taking blood samples.

Ms. Fenton. Yes.

Senator Merkley. So does this hold constant, all the other factors, like cigarette smoking is associated with lower birth weight, is this an area that we really have a pretty clear understanding of an impact?

Ms. Fenton. Yes, sir, thank you for the question.

There are dozens of studies that have shown consistent effects from PFAS-associated decreases in birth weight. Those are epidemiological studies that take into consideration all the

things that you were just mentioning, smoking, poor nutrition, socioeconomic status, even the BMI of the mother. They take those many variables into consideration when they do the analysis in the studies. They are controlled for, so those are things that they control for.

Senator Merkley. Okay, so we see this in human studies. But then you also mentioned mice studies. In the mice studies, they show the same thing. You mentioned mice that, I think you called them pups, is that the correct term?

Ms. Fenton. Yes.

Senator Merkley. And that we have seen the same effects. So we have both the human studies and the laboratory studies reinforcing each other?

Ms. Fenton. Correct. In fact, the University of California San Francisco did a systematic review of all the studies that had shown birth weight outcomes in mouse studies, and at the time, all the studies that had shown birth weight outcomes in human studies. They reviewed them both altogether.

So when I say a systematic review, that is all the information that is available in the literature.

Senator Merkley. So lower birth weight can be an indication of other things, but maybe not the immediate highest concern. But it is an indication of something that is going on. But you mentioned some very specific things, like breast

development abnormalities. Is that in humans or is that in mice, or both?

Ms. Fenton. I first reported it in mice, and since then, there have been nine studies in women showing that PFAS and PFOA specifically and a few other handful of other PFAS are associated with women not being able to nurse their children. So they have a shorter duration of lactation, is the specific term they are using in these papers.

And this is not just in the U.S. Several of these studies are from other countries. Several are from the U.S. They are showing very consistent --

Senator Merkley. I want to keep this moving. How about other diseases where the studies have shown a significant correlation? For example, you mentioned fatty liver disease. I don't even know what that is, but maybe you are about to tell me. Also, are there other things? Do they show higher cancer rates, for example, for breast cancer or prostate cancer?

Ms. Fenton. Yes. So some of the things that we have in common are thyroid disease. Definitely changes in fatty liver. Fatty liver is when, and you can tell if a person has fatty liver from their clinical enzymes. When you go to the doctor and they say they are going to do a liver panel on you, you can tell if you have some adverse outcomes in your liver based on those clinical, easy to acquire outcomes. You do a blood draw

and they can tell you then.

But the fat that is accumulating in the liver can lead to non-reparable damage to the liver. That would be like steatosis, when the liver can become fibrous. Once that happens, it is not reversible. Whereas fatty liver is reversible.

Senator Merkley. So if you were to name the top four health concerns, would they be the ones you have just mentioned? Or what would the top four health concerns be that there is clear studies associated with higher PFAS?

Ms. Fenton. Birth outcomes, one. Metabolic disease.

Senator Merkley. Birth outcomes, meaning miscarriages? Meaning stillborn? Or simply the lower weight?

Ms. Fenton. Smaller birth weight. And there is really good evidence that links smaller birth weight to long-term adverse health outcomes. There are thousands of papers that link it to that. This is not just a PFAS issue. Anything, like poor nutrition, cigarette smoking, anything that causes lower birth weight can lead to adverse outcomes later in life, long-term.

So definitely birth outcomes. The thyroid disease is a big deal. Immune suppression I would say is one of the biggest issues. And we do know that PFAS suppresses the ability of the body to properly respond to a vaccination. This is really

important in our children. And if children are given PFAS in their breast, from their mom, this really brings home a very important point. We want moms to breast feed their babies because they provide to the baby immunoglobulins in the milk that help the little infant develop their immune system. But if PFAS are inhibiting that proper production of a proper immune system, this can lead to long-term immune problems for the person.

Senator Merkley. Thank you.

Senator Mullin?

Senator Mullin. How many different forms of PFAS is there?

Ms. Fenton. A lot.

Ms. Schaider. The number seems to keep changing. The most recent --

Senator Mullin. Thousands?

Ms. Schaider. -- estimate by EPA is over 14,000.

Senator Mullin. Okay, so I just, I know, have we ever been able to identify which PFAS is causing this problem? Just yes or I don't know.

Ms. Schaider. Yes.

Senator Mullin. So we can specifically look at those and maybe be able to separate those from the other ones. Because I mean, when you are talking about immune shots, right, every needle out there has Teflon on it. That's what the plunger is

able to slide up and down in. And so when they are getting injections, you are getting shots, it is Teflon. I am just saying that it is literally everywhere. And I don't know how you can possibly think we are going to ban PFAS if we don't look for what the alternative is going to be. And there is 14,000 and counting different forms of PFAS.

And I go back to my original statement, is, at which form, because you are creating it, so it is a chemical that you are creating, at which form or which deterioration does it become harmful? Where is the curve? Is it at the final product or the curve going down?

I know you have a lot to say about it, but I have to move. I am just bringing the question to mind, because we are talking about the effects but we are not talking about when it actually takes place.

I want to talk about semiconductors, and I need to send something for the record. Mr. Chairman, I would like to submit for the record a letter emphasizing the critical role certain PFAS play in manufacturing for the semiconductor industry.

Senator Merkley. Without objection, so ordered.

[The referenced information follows:]

Senator Mullin. Dr. Larrañaga, is that close?

Mr. Larrañaga. Yes, sir.

Senator Mullin. Okay. Given your experience in leading risk assessments in the semiconductor industry, what are the potential impacts of blanket regulatory ban on PFAS in this sector?

Mr. Larrañaga. So there are several impacts in this sector, one being the fabs which are tremendously expensive that build semiconductors would have to retool. In order to do precision manufacturing at the nano scale, at least currently with the technologies we have, PFAS are required. There is no way to do it without PFAS with the level of precision that is necessary to make a semiconductor chip.

If we were not to be able to make those semiconductor chips, a couple of things would happen. One, our chips would have to become larger. Two, they would be less efficient and less capable as well as being less durable. Meanwhile, our competitors, China and other countries, would be increasing their computing power at the same time we would be decreasing our computing power.

So from a semiconductor perspective, it is very important that we are able to use PFAS in this industry.

Senator Mullin. So basically what I am hearing is that it could greatly disrupt the supply chain?

Mr. Larrañaga. It would tremendously disrupt the supply chain, yes, sir.

Senator Mullin. Pointing out to other things that are involved with PFAS, many life-saving medications containing PFAS substances are antidepressants, autoinflammatory drugs, certain essential cancer treatments, and even Lipitor contains PFAS. I just point that out once again, it is literally everywhere.

Sir, do you agree that this indicates that not all PFAS have the same impact on human health and therefore should be treated differently based on each chemical's properties and risk profile?

Mr. Larrañaga. Yes, sir, I do believe that the different PFAS chemicals will have different chemical properties and that we should look at them individually based on health risk frameworks.

Not only medications, but actually medical instruments, like the semiconductors, they would have to get larger. Imagine a pacemaker inserted into someone's chest would have to become larger, also, because the PFAS chemicals that are used in the circuitry or on the wiring and in the actual chips that are used, the brain of the pacemaker. So those would have to become larger as well.

So it has these -- banning these as an entire class has these long-reaching effects that would affect our public health

and health care at large.

Senator Mullin. So what we are searching for here is instructions or direction on as we are looking for policy, how do we approach regulating it? And I think that is the question that we could tackle to some degree, if you have thoughts, short, because I am a little over time. But for all of you guys, what is the best way for us to tackle this?

I know, Chairman Merkley, he is being thoughtful in this direction, which I appreciate. We understand not one size fits all, in my opening statement. We want to make sure that we don't overreact. So just really quickly if you could, what are your thoughts?

Ms. Fenton. Senator, if I could, I think that there are essential uses, potentially. And potentially, we are not exposed to the products very often. But we may be exposed to the waste. I want to just mention that.

Proper disposal of the waste in these industries is super important. Because if you think about it, think about how few people may actually ever touch a semiconductor or put their fingers on the wiring that my colleague is talking about. But the waste coming from the industries that make them go into water bodies, go into the air that we all breathe.

Senator Mullin. So focus on the waste. I think that was kind of a point I made before, at which level does it become

harmful.

Ms. Fenton. Yes. And to your point earlier, when you think about the classes of PFAS that might cause health effects, the current regulation that is in place from the EPA will remove the compounds that cause, that we know already cause some of these health effects. So if we can keep that regulation in place, it will take those PFAS out of water, out of air.

Senator Mullin. The problem is that some of those compounds, it is taking away from the critical needs that we already have. Some of the compounds to which they are referring to, the EPA, it is, what is it taking out of the industry that we are using every single day that is critical of our life.

And so to some degree, I do feel like the EPA, not some degree, the EPA in its direction I think overreacted. Do I have time to look for that response, too, sir? You are the chairman.

Senator Merkley. Why don't we come back after Senator Markey?

Senator Mullin. Oh, sorry, sir. I didn't know you were here. I will yield back.

Senator Merkley. Senator Markey?

Senator Markey. Thank you, Mr. Chairman. Thank you for having this very important hearing.

Dr. Schaidler, thank you for your years of service in women's health space. My wife was a two-star admiral in charge

of all women's health in America. So I appreciate your service.

Recent reports and studies show that soils examined show that hazardous waste incinerators have elevated levels of PFAS. These incinerators are disproportionately in disadvantaged communities. Toxic PFAS emissions get into the atmosphere when they can hurt children, pregnant women, agriculture soil, air.

Can continuous monitoring of any air emissions protect our communities from being exposed to PFAS coming from hazardous waste incinerators?

Ms. Schaider. Thank you for that question, Senator Markey. I think the concerns about incineration of PFAS are really critical to consider. I appreciate your raising concerns about environmental justice and the communities that live around incinerators.

There are new, improving methods for how we measure PFAS. I think it is important if there is going to be incineration of PFAS-containing materials that we are carefully monitoring for the full suite of PFAS that are there.

But I have concerns about incineration and what that might mean for exposures among people living in these communities. I think those kinds of life cycle issues are really why we need to be really judicious when we are creating these highly persistent chemicals that really don't break down.

Senator Markey. Thank you.

Dr. Schaider, firefighters protect us from harmful fires. But we need to help protect them from being harmed by the gear they wear, which is full of PFAS. So firefighters are just walking around covered in PFAS. We need to protect our protectors from cancer clusters in firehouses.

Dr. Schaider, is it true that PFAS in firefighters' turnout gear and firefighting foams can harm their health?

Ms. Schaider. Thank you for that question as well. There is a huge concern right now among firefighters about their exposures to PFAS. As you said, that can come from the firefighter turnout gear, which has typically had a PFAS Teflon layer.

Senator Markey. Are there alternatives?

Ms. Schaider. There are alternatives, and actually, our State of Massachusetts just instituted a ban on PFAS in firefighter turnout gear. So I am proud of our State for advancing that. I think it is an example of when we set a goal to reduce exposures and protecting firefighters' health, it is critically important that new research and development can provide solutions, so that we are keeping our protectors safe but also not exposing them to toxic chemicals.

Senator Markey. I agree. And I think it is something that we should think about on a national level, because, well, obviously so many of our firefighters do die from cancer. We

want to make sure that we give them the protections which they deserve.

The Agency for Toxic Substances and Disease Registry conducted an exposure assessment in Westfield, Massachusetts, one of the 10 cities included in the Centers for Disease Control and Prevention's PFAS Exposure Assessment. While random households were invited to participate, the data collected was not fully shared with the public.

Dr. Schaider, do you agree that more data transparency would be helpful to allow the public to understand their exposures, risks and pathways?

Ms. Schaider. Thanks for that question. I know that the ATSDR has released summary statistics for the results of blood testing that they conducted in Westfield. I am not familiar with the specifics.

Senator Markey. Should that be made fully available?

Ms. Schaider. Certainly the summary statistics of how people, in the blood levels that they tested in Westfield residents, how those compare to the general population, what is the median level, what is the 95th percentile, those summary statistics have been made available. I am not familiar with the specifics of the extent of data released.

Senator Markey. Yes.

Ms. Schaider. But I in general think that having more

information about exposures among the general population and exposed communities is helpful.

Senator Markey. Yes, we would want to ensure that there is total access to the information about the safety of breastfeeding for PFAS-exposed mothers, especially considering the potential health risks to children. So it would be, I think, a very important thing that we could do.

The EPA's updated draft PFAS disposal guidance document acknowledges that performance and testing data are needed to validate PFAS, destruction by incineration as opposed to other novel ways of getting rid of PFAS in our environment.

Dr. Fenton, do you believe that attempting standard incineration of PFAS can lead to more dangerous PFAS compounds released into our environment?

Ms. Fenton. Thank you for the question, Senator. We certainly know that incineration can lead to release into the environment. What I suggested earlier in my comments was that funding innovative ways to mineralize these compounds, or re-use what is being released from the incineration might be useful down the road. I do think there is a place that we can fund innovation yet, and work toward a place where we are not releasing fluorine carbon compounds into the environment.

Senator Markey. With your indulgence, Mr. Chairman?

Senator Merkley. Go ahead.

Senator Markey. Dr. Fenton, do you believe that the failure of PFAS manufacturers to provide reference standards to the EPA has hindered the agency's ability to establish accurate drinking water standards for PFAS? Has this lack of cooperation hurt communities across the United States?

Ms. Fenton. Sir, it has affected how quickly and how efficiently we can provide strong data, high quality data, on health effects. It has affected me personally; it has affected my colleagues. The confidential business information in some of the PFAS mixtures has really hindered our progress in understanding the health effects.

That is probably the number one issue that I have had to deal with, is the inability to get standards for some of the new compounds that we would like to study in North Carolina, in particular.

Senator Markey. Thank you. It is absolutely critical.

I had my first date with my wife 40 years ago, in two more months, Mr. Chairman. And she was explaining to me, her mother had died from breast cancer. And she was explaining to me that her interest in medicine was driven by that, and having to go to the Stanford Hospital day after day, it was a girl with her mother for the treatment.

But what she explained to me was this, that Japanese women contract breast cancer at only one-third the rate of American

women. But Japanese women contract breast cancer at the same rate as American women in the first generation that they live in America. Meaning that we are doing something to ourselves with our environment, what we put into our food, what we put into our water, what we put into the air. We do it to ourselves. And it causes a much higher level of cancers in our society.

So we just can't deny these statistical realities when we compare ourselves to the rest of the world. While manufacturers might want to just continue business as usual, the impact has been felt by the families, the women, the children, in our society, the firefighters who get exposed and ultimately succumb to the diseases.

I thank you so much for this very important hearing.

Senator Merkley. Thank you very much, Senator.

I notice that when we have a conversation about, and testimony about, well, PFAS in our food and water is causing bad health effects, often the response is, oh, but wait, it is on other things in our environment like insulated wire in an airplane or coating a solar panel, to try to distract us, essentially, from the fundamental question of the pathways in which we are affected, and how it can be removed in those pathways that are affecting human health.

So this is not a conversation about banning a class of chemicals. It is a conversation about finding the ways that we

are affected and eliminating those effects to improve human health.

I think it is a very good point you made, however, Dr. Fenton, that the waste that happens from other portions of the industry may well find its way back into our bodies, even if the initial product is not one where we are touching or around. One of those products is stain-resistant carpet. I remember when the ads came out about, oh, you can drop all kinds of things on the carpet and it just beads up, and so forth. Is that a PFAS treatment? I am thinking about our little babies crawling around on the carpet. Is that a risk to our babies' health?

Ms. Schaider. I would say absolutely yes. We do know that stain-resistant carpets treated with Scotch Guard or Stainmaster contain PFAS. And there is ample evidence that the chemicals don't stay in the product. There have been studies that have made links between people who have stain-resistant carpets in their house and levels of PFAS in their blood.

Also I have concerns about children who are more vulnerable, spend more time close to the ground, spend more time with their hands in their mouth. We know that PFAS can get through our skin, but also can be transferred by hand to mouth contact in children who are more vulnerable to those harmful health effects.

So we know that having these products in our home increases

our exposure. And I think one point that is important to keep in mind, and Senator Mullin had asked about all these different ways that we can be exposed, all those cumulative exposures add up. We can be exposed from food and water and consumer products.

Some pathways of exposure are easier to turn off now, and I think we should grab that low-hanging fruit and reduce exposures where we can. Other pathways may be more challenging. But we should work, in general, to reduce our exposures to PFAS and reduce our reliance on these problematic chemicals.

Senator Merkley. I have kind of been assuming that areas where you have higher abrasion may produce more particles that find their way into our bodies. Maybe that is wrong. But for example, I think about carpets, we are walking on them, there is abrasion, there is carpet dust. That carpet dust, those fibers that have PFAS on them because they are stain resistant or spill resistant now are easily breathed in and therefore have a pathway to get into our bodies.

I have thought about the Teflon pans, and I have seen many Teflon pans where the coating has essentially been worn off from stirring things in the pan. And of course, you noted that heat can be a factor as well.

It seems a lot more of a risk than, say, a coating on my phone, where one, I can put a plastic cover over that coating,

so I am not touching it. But even if I am, there is not the abrasion involved and I am guessing that the transfer of PFAS through my thumb might be far lower.

So our goal here is to figure out and understand better where the highest levels of transfer, as you call it, low-hanging fruit, that can have an impact. But my assumption about abrasion, is that a reasonable way to think about some of this?

Ms. Schaidler. I think that is one. One way to think about, I think a lot about how we actually get exposed to the PFAS and how do the chemicals and the products get into our bodies. So certainly, abrasion of products and fibers ending up in dust, we don't think about dust as a harmful chemical exposure pathway. But the dust in our homes is one way that we can be exposed to toxic chemicals. It is sort of a repository for toxic chemicals in homes.

Also, there are certain PFAS chemicals that are volatile. So some of the PFAS that we are talking about in water are polar, they tend to stay in water. But other PFAS chemicals, like fluorotelomer alcohols are volatile, so they can actually come off of products and end up in the air in our homes. Then we breathe them in.

Fluorotelomer alcohols are an example of a precursor. So we think of PFAS, PFOA, those chemical structures basically don't change unless you heat them at very high temperatures.

Other chemicals like these fluorotelomer alcohols are what we call precursors. So in our bodies, over time and in the environment, they can be transformed into PFAS or PFOA or these other very stable PFAS.

So that is another way we can be exposed, is through these volatile PFAS, that we do measure in indoor air and we do see that homes with PFAS-containing products have higher levels in air and dust.

Senator Merkley. So the question we might be asking when we hear that there is PFAS on our cell phone is, is that a volatile version. I will ask that for the record. I will have my team follow up.

I want to note that you all mentioned cosmetics. Why would cosmetics contain PFAS? And cosmetics certainly produce dust, if you will, that we breathe in. Is there any rational reason to have PFAS in cosmetics?

Ms. Fenton. They do it for waterproofing. It is like waterproof mascara and waterproof foundation that you would put on your face. It is meant to last all day.

Senator Merkley. Is that absorbed through the skin? Because now you are applying something directly to a significant area of skin. Is that a much higher risk than some other sources?

Ms. Fenton. Like all sources, it is how often you are

exposed to it. So if you are wearing it every day as an individual, yes, you probably would have substantial exposure from that. But you can make personal choices, like you can make a personal choice not to have Scotch Guarded upholstery or mattresses or carpeting or cosmetics.

Senator Merkley. But the thing is, Dr. Fenton, that citizens assume when they don't see a warning on it, it doesn't say, this carpet has Scotch Guard that will reduce your stains but also beware that your children may breathe in a whole lot of PFAS that may have health impacts. They don't put warnings on them. This is where we are relying upon every citizen to be educated, like each of you have doctorates, and make individual choices. That is why we have public policy, and that is why we are struggling with this.

Of course, I have never used stain-resistant mascara - what did you call it?

Ms. Fenton. Waterproof mascara.

[Laughter.]

Senator Merkley. I have never used mascara. I had no idea there was PFAS in it. But I am sure I can see a reason for that. Do we have studies that show cosmetics as you are describing, incorporating these water-resistant qualities, result in PFAS in the blood? Is it a pathway of concern?

Ms. Schaidler. I am not aware of specific studies that have

looked at that question. But I think we know enough about how these chemicals can come out of products. As Dr. Fenton mentioned, they can be absorbed through our skin.

I don't know that we need to do a study for every single product to show what percent of that PFAS ends up in our blood. I would take more of a precautionary approach, because we know that if chemicals are in products, at least some portion of that will end up in our bloodstream. And if we are talking about waterproof mascara, that is really not an essential use. I think that is an easy one to point out.

We often say that you shouldn't need a chemistry degree to go shopping for products for your family. I think it is unfair to expect that consumers will know all the different types of harmful chemicals that they should avoid. As the mother of a 'tween daughter who is getting into makeup, it is impossible to think that every person needs to know about these toxic chemicals. I think people rightfully expect that the government is protecting their health.

Senator Merkley. That not always is the case.

So my last question is really about the April EPA drinking water regulations for six PFAS chemicals. I think these are the regulations that were being referred to before. The level that they set is very, very low, like parts per trillion. I am used to parts per million or billion, but I have never seen a parts

per trillion before.

But now imagine that you are providing the water to a municipality. And you test and you go, oh, gosh, we have our water, the groundwater is contaminated with PFAS, we are pulling it out of the ground or whatever. Is it possible to really, is there any real cost-effective way to pull this PFAS, the parts per trillion, out of our drinking water?

Ms. Fenton. Yes.

Senator Merkley. Okay, tell us about that.

Ms. Fenton. Granular activated charcoal systems, large volume systems, have been implemented in multiple cities across the United States already. Because as you know, 11 States already had PFAS regulations on the books, only 11. So this Federal law now protects all States at a level that is safe.

So 11 States have already figured out how to do this, and they are doing it. Some of them are doing it without increasing the water bill to their constituents.

Senator Merkley. So we have a cost-effective way to get this out of our water.

Ms. Fenton. Yes.

Senator Merkley. Since water, you have all mentioned, is a major pathway, that is a real positive to accomplish that.

Ms. Fenton. Right.

Ms. Schaidler. It is cost-effective, but there are

economies of scale. So that works really well when you are a large water system, the cost per person decreases. But for small water systems with a small customer base, these systems are hugely expensive.

For instance, on Hyannis, on Cape Cod in Massachusetts, where we have been studying PFAS for a number of years, there are only 14,000 customers. All of their public wells were contaminated by PFAS and they have had to spend tens of millions of dollars to install granular activated carbon to remove the PFAS. I don't think it is fair for the ratepayers to foot that bill. I would like to see more pathways for the chemical industries who created the chemicals and profited from them to be responsible for the cleanup.

Senator Merkley. Polluter pays, is your principle.

Ms. Schaidler. Yes.

Senator Merkley. Well, this is a really interesting and important conversation that we are having. Obviously, it is a very complicated one. So I really appreciate your bringing your expertise to bear, and hopefully it will cause others who are listening go, oh, we need to explore this further and think about how do we capture that low-hanging fruit.

Should we be labeling things that warn individuals about the effects? Should we simply be, in certain products, and maybe it is the stain-resistant carpet saying no, that the

health risk far outweighs any value, or so forth?

There is a lot to follow up on. I really appreciate your contributions and expertise.

Ms. Fenton. Senator, could I suggest for the record that what you brought up about the policies on the labeling would be enormously useful to all Americans. If we knew which consumer products had PFAS in them, we could make better choices. We could change things. We could have some say by ourselves in our exposures.

Senator Merkley. Let's follow up on that question. Because one of the things that is in my head is I heard about lots of things that have PFAS I had no idea about, whether it is medical equipment or a screen of a cell phone. But there may be categories where that labeling is more important because the pathways of contamination are more significant. Maybe it is cosmetics, maybe it is carpet, I don't know.

We will look to your expertise to help guide us. My team will keep wrestling with it. So thank you for that point.

In closing, thank you again. We have heard that the scientific community is deeply concerned about the public's exposure to toxic PFAS chemicals. We have heard about the impact, both observed from human studies and from studies on mice, that the health effects are very significant, and therefore a topic we should continue to explore how to reduce

this risk dramatically for our citizens.

I ask unanimous consent from all my colleagues who are still at the table here to approve submissions for the record that they might like to make, including any letters they would like to submit or articles or other material.

[The referenced information follows:]

Senator Merkley. And if any of them wish to submit written questions for the record, that is allowed through the close of business on December 19th of this year. We will compile those questions; we will send them out to you all. And your replies, if you can get them back to us by January 9th, it would be very helpful, so it can be timely and close out the record.

So without hearing any objection to that, that is the plan. This hearing is adjourned.

[Whereupon, at 11:05 a.m., the hearing was adjourned.]