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U.S. Senate Date: Tuesday, February 27, 2024

Committee on Environment
and Public Works

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

joint with the

Subcommittee on Fisheries, Water, and Wildlife

Washington, D.C.

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HEARING ON UNDERSTANDING THE PRESENCE OF MICROPLASTICS IN WATER

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The subcommittees met, pursuant to notice, at 2:30 p.m., in Room 406, Dirksen Senate Office Building, the Honorable Jeff Merkley [chairman of the subcommittee on Chemical Safety, Waste Management, Environmental Justice, and Regulatory Oversight] presiding.

Present: Senators Merkley, Carper, Padilla, Mullin, Lummis, Whitehouse, Sullivan.

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

Senator Merkley. Good afternoon. Welcome, everyone. This joint hearing of the Environment and Public Works Subcommittees on Chemical Safety, Waste Management, Environmental Justice, and Regulatory Oversight and Fisheries, Water, and Wildlife on understanding the presence of microplastics in water will come to order.

As one of our witnesses today, Dr. Sherri Mason, said, normal humans looking at a sample of water, if there is visible plastic in it, they will be turned off. But they don't realize it is actually the invisible plastics present that are the biggest concern. Thank you for sharing that line and allowing me to steal it from you. Those invisible plastics are why we are here today.

Like people shed skin cells, plastics shed particles of plastics. These can be big microplastics, which range from half a centimeter down to a micrometer, a micrometer being less than one-70th the size of a human hair, or they can be as small as nano plastics, which are even smaller than a micrometer.

Not surprisingly, we are finding microplastics everywhere: on top of mountains, at the bottom of the sea, in the food we eat, in the air we breathe, in drops of rain, and even drops of our own blood. Microplastics have been found in our livers, our

lungs, and the breast milk we feed our babies.

Even when folks try to avoid using plastics, products like paper cups and aluminum cans now have plastic linings. This should set off public health alarm bells for everyone, because microplastics leech chemicals, chemicals like endocrine disruptors that affect the reproductive system and are a major suspect in the decline of male fertility worldwide, chemicals that lead to weight gain, chemicals that lead to insulin resistance, chemicals that cause cancer.

Congress has taken important first steps to address plastics in our water, like the Microbead-Free Waters Act of 2015, based on the research of one of our witnesses, Dr. Mason. This legislation banned cosmetics with intentionally added plastic microbeads that did nothing for consumers but did pollute our waterways.

Since then, we have learned that the problem of plastic pollution is so much more extensive than microbeads, and so much smaller, too, in terms of micro and nano plastics.

Microplastics shed into our water every time we use plastic water bottles, every time we wash clothing made from a whole series of products that we may not even think of as plastics, but are plastics, nylon, polyester, other synthetic materials. Every time, it seems that water interacts with plastic.

Our water treatment systems filter out many harmful

contaminants, but the filters have plastic components that could be inadvertently polluting the water with microplastics. We can't forget that biosolids from wastewater treatment and agricultural fertilizer also contain microplastics, and when those biosolids are put onto lands, they can run off into our streams and waterways, creating additional plastic challenges, which is why I have introduced the Research for Healthy Soils Act to make this a high priority research area for the Department of Agriculture.

We need to think better; we need to think bigger. We need to think about how to stop micro and nano plastics from getting into the water in the first place and how to filter them out when they already exist. Thanks to current research on microplastics and microfibers, including work led by one of our witnesses today, Dr. Brander, from Oregon State University, States are starting to act. Legislation was recently introduced in my home State of Oregon that would require all new washing machines sold in Oregon to include a built-in microfiber filtration system.

State-led efforts are important, but microplastics don't stop at the State border, so we also need national attention. Fortunately, we have been joined by a panel of experts today who can help us understand what those national solutions might look like.

Dr. Susanne Brander is an ecotoxicologist and Associate Professor at Oregon State University whose research focuses on microplastics and how they affect behavior and growth in fish and other water organisms. She is also a co-leader of the Pacific Northwest Consortium on Plastics.

Also joining us today is Dr. Sherri "Sam" Mason, Associate Research Professor and Director of Sustainability at Penn State Behrend in Erie, Pennsylvania. Her research on freshwater microplastics has led to plastics legislation here in the United States, as well as other places around the world.

We are also joined by Brent Alspach, Vice President and Director of Applied Research at Arcadis, where he oversees their water division's research on drinking water, recycled water, wastewater, and stormwater.

Thank you all for taking the time to share your expertise with us.

We will reserve the opportunity for Senator Mullin as Ranking Member to give his opening remarks, so when he is able to get here. I hear that he is on his way. He will also be followed by opening remarks from our colleagues on the fisheries subcommittee, and let me turn this over to Chairman Padilla.

[The prepared statement of Senator Merkley follows:]

STATEMENT OF THE HONORABLE ALEX PADILLA, A UNITED STATES SENATOR FROM THE STATE OF CALIFORNIA

Senator Padilla. Thank you, Senator Merkley. Good afternoon, everybody, and thank you to my colleagues on both sides of the aisle for participating in this joint hearing between our respective subcommittees, mine being the Senate Environment and Public Works Subcommittee on Fisheries, Water, and Wildlife.

Today, we have the privilege of co-chairing this hearing, along with our Republican colleagues. This is going to be a substantive and important discussion. We are teaming up to examine the issue of microplastics, including nano plastics in our drinking water and in wastewater.

I want to just not brag too much, but call attention to my involvement in the issue since before I even joined the Senate. In fact, I was serving as California's Secretary of State in the year 2020 when I joined Senator Dan Sullivan from Alaska at a virtual event hosted by the Massachusetts Institute of Technology, focused on the dangers of plastic pollution, each of us sharing our work experience and legislative experience at that point.

As Senator Sullivan so eloquently articulated then, we knew that the issue truly can be an opportunity for bipartisan cooperation, especially as we support this emerging area of

research. While the study of microplastics is in fact still emerging, one thing we do know beyond a shadow of a doubt is where we can find microplastics, because the answer is everywhere. It is all around us.

These tiny, sometimes microscopic shards and fragments of plastic less than 5 millimeters in length have been found in the clouds above our skies, in the depths of the oceans, and literally everywhere in between.

Just last summer, here is another, I am not trying to brag too, too much, but I participated in the 27th Annual Lake Tahoe Summit where the governors and senators from both California and Nevada convened at the lake to talk about cooperation between our States and the Federal Government to protect this tremendous jewel, this tremendous natural resource.

I was reminded that even in a natural wonder like Lake Tahoe, given its high elevation, given its pristine, clear blue water, surrounded by nothing but scenic mountaintops and trees, with all the multi-State, multi-jurisdictional environmental protections, even there, microplastics is a problem. It is no surprise that if you can find them there, then you will find them in everyday products like plastic water bottles with "hundreds of thousands of bits of plastic per liter of water."

These findings should alarm us, folks. They should alarm us into action. Just how pervasive are microplastics in the

water that we drink?

Well, I am proud to say that in California, we are trying to lead the way in trying to answer the question as the first government in the world to set requirements for testing microplastics in drinking water. Our State is trying to lead the way. This serves as a model, by the way, that other States, as well as the Federal Government, can follow in the coming years.

We also know that microplastics are already so common that increasingly, we have found them in stomachs of sea animals, in our own food and water, and yes, even in human lungs and bloodstreams. While we continue to learn more and more about the presence of microplastics on the planet, the question must also become, what are the potential impacts of microplastics on human health?

To explore just that, I want to thank all of our witnesses for being here today. I am certainly looking forward to hearing more about the state of your research and how Congress can help protect the health of not just our environment, but our constituents and the future generations.

With that, thank you again, Senator Merkley. If I can now hand it over to the Ranking Member of our subcommittee, my friend and colleague, Senator Lummis.

[The prepared statement of Senator Padilla follows:]

STATEMENT OF THE HONORABLE CYNTHIA LUMMIS, A UNITED STATES SENATOR FROM THE STATE OF WYOMING

Senator Lummis. Thank you, Chairman Merkley, and thank you, Chairman Padilla.

As you were talking, I had a recollection and a mental image. I got to fly over Lake Tahoe in a very small plane back in 1977 when I was working for a rodeo contractor in Northern California. The plane was piloted by Joe Alexander, who was the world champion bareback bronc rider in the world, and we flew over and we buzzed Lake Tahoe.

It was unforgettable, unforgettable. You have such a beautiful State, and it is such a privilege for me to serve with you as Ranking Member on the Fisheries, Water, and Wildlife Subcommittee. Thank you as well, Chairman Merkley. We all come from the west, beautiful States, and this is an important topic to all of us.

Under the Safe Drinking Water Act, the EPA set regulations for over 90 different contaminants in public water. These supplies have such contaminants as arsenic, asbestos, lead, mercury, and many other substances that are proven to harm human health. The contaminants on this list did not appear overnight.

Generally, the process of adding contaminants to the National Primary Drinking Water Regulations is thorough, rigorous, and multifaceted. It is a years-long process based on

solid, scientific data. Today's hearing focuses on the potential presence of microplastics in drinking water and wastewater. I am glad we have convened a panel of academic witnesses to discuss this topic.

The consensus on microplastics and their effect on human health is that there really is no consensus. So we need to start diving into this and understanding it better, as members of the U.S. Senate. According to the American Water Works Association, while we are aware of the existence of microplastics in the environment, their occurrence in drinking water sources is not well defined.

Additionally, the effectiveness of treatment processes and removing them is not well understood, certainly by me, and perhaps by others. Assessing the associated health effects has proven challenging.

Despite the large number of unknowns, there continues to be considerable public interest in this topic. While water utilities have their hands full with numerous challenges, including PFAS, lead contamination, infrastructure repair, and many others, I applaud the industry for continuing to further its research on microplastics.

Again, thanks to all our witnesses. I really appreciate your being here. I really appreciate the fact that I am going to get to learn a lot from you, and I look forward to this

conversation.

Mr. Chairman, I yield back. Thank you.

[The prepared statement of Senator Lummis follows:]

Senator Merkley. Thank you very much, Senator Lummis.

Senator Mullin has offered to enter his statement for the record. Is there any objection? Hearing none, so ordered.

[The prepared statement of Senator Mullin follows:]

Senator Merkley. We are now going to turn to our experts to actually get some insights here. We are going to start with Dr. Brander.

STATEMENT OF SUSANNE M. BRANDER, PH.D., ASSOCIATE PROFESSOR, OREGON STATE UNIVERSITY, COLLEGE OF AGRICULTURAL SCIENCES, DEPARTMENT OF FISHERIES, WILDLIFE, AND CONSERVATION SCIENCES

Ms. Brander. Thank you, Chairmen Merkley and Padilla, and Ranking Members Lummis and Mullin for the opportunity to testify today on the potential for microplastics in drinking and wastewater to have repercussions for environmental and human health.

I am an associate professor at Oregon State University and have been conducting research on microplastics and plastic pollution for nearly a decade, and on endocrine disrupting chemicals for over a decade. The issue of plastic pollution is a great environmental challenge, as has been mentioned.

It is also an expensive problem, estimated at about $13 billion annually. Fragmentation of plastic products and waste into microplastics is of substantial concern to the Nation's water treatment sector, where contamination is widely documented.

Microplastics are now broadly defined by California as a solid polymeric material to which chemical additives or other substances may have been added. These are particles having at least three dimensions greater than one nanometer and less than five millimeters.

Formulations of plastics are estimated to use upwards of

13,000 chemicals, and microplastics are widely documented to harm aquatic and terrestrial wildlife. They can slow growth, alter behavior, and cause reproductive disruption. They also cause adverse effects in mammals, and particle presence is now confirmed in the human heart, placenta, and lung tissues, as well as in circulation in the bloodstream.

Microplastics in wastewater and in drinking water are, of course, originating from multiple sources. Influent to treatment plants contains synthetic microfibers shed from our laundry, breakdown of plastics from dishwashers, and plastic detergent pods.

Washing of one synthetic garment is estimated to generate over 100,000 microfibers, and an average load produces upwards of 9 million, and dryers emit them too, potentially on a larger scale. Dishwashers can also generate thousands of microplastics per cycle. A medium-sized town could emit over 300 million microplastics on a daily basis from a recent study.

The burden of dealing with these has really shifted to wastewater treatment plants and drinking plants. Wastewater treatment plants tend to retain most of these particles in the sludge, which is sterilized into biosolids and, as Senator Merkley mentioned, these are used as fertilizers, and those particles can be washed back. All of these discharges are unregulated.

While drinking water in the U.S. does contain fewer microplastics in comparison to wastewater, the U.S. does have among the highest prevalence of microfibers in its drinking water and the highest number of particles detected per liter, currently. Results on studies in rodents, which are used as human health models, suggests the potential for impacts of this long-term exposure to markers like reproductive and microbiome health.

Far less is known about the occurrence and effects of tinier particles, which were also mentioned in the introductory remarks, these nano plastics. Tap water, like bottled water, was recently shown to contain high levels of nano plastics, but the methods for detecting these smaller sized fractions are expensive and limited, currently. The smaller particles have the capability to move around within the body following ingestion, and they can also potentially accumulate. Bottled water, which contains higher levels of microplastics, is disproportionately consumed by marginalized communities, as well.

Experts agree that source reduction of plastics is needed, but of course, this is challenging, given that these are deeply embedded as far as use goes in our daily lives, and that the shedding of microplastics is challenging to control. But this challenge must be addressed across multiple sectors for progress

to be made. We have accumulating evidence that as these microplastics degrade into smaller sizes, they can elicit inflammation, cellular toxicity, and myocardial damage.

A next step would be to take action to limit their presence in our waterways and in our bodies. Potential solutions include requiring microfiber filters on washing machines, as a bill has been introduced in Oregon and in California, as well. Also, catchments and rain gardens can significantly reduce plastic pollution from stormwater runoff.

Our Nation's waterways are intended to be protected by the Clean Water Act, which in 1972 established a framework for regulating pollutant discharges. However, the CWA has not yet been used, of course, as you know, to limit the discharge of microplastics. Given that microplastics and their precursors could be defined as originating from point sources, such as pellets, discharge of microplastics from treatment plants, or the recent vinyl chloride spill, the CWA provides the most direct route for potential regulation.

Long-term solutions are greatly needed, including better waste management strategies and a move towards globally touted approaches for circularity.

With that, thank you so much for the opportunity to testify today. I am pleased to answer any questions that may come up.

[The prepared statement of Ms. Brander follows:]

Senator Merkley. Thank you very much, Dr. Brander.

Dr. Mason?

STATEMENT OF SHERRI A. MASON, PH.D., DIRECTOR OF SUSTAINABILITY, PENN STATE BEHREND

Ms. Mason. Thank you, subcommittee Chairmen Merkley and Padilla, and Ranking Members Mullin and Lummis, and other subcommittee members for the opportunity to speak at this hearing.

My name is Dr. Sherri Mason. I am a chemist and currently the Director of Sustainability at the Erie Campus of Penn State.

When many think of plastic pollution as an issue, they think of mass collections of debris in the oceans. While oceans are certainly important, science has made it clear over the past decade that this is not an oceans-only problem; it is a water problem.

My research group was among the first to study plastic pollution in freshwater ecosystems. Our study formed the basis of the science upon which the Microbeads-Free Water Act of 2015 was based. Years later, we would also be the first research lab to examine wastewater treatment plant effluent, as well as tap water and bottled water.

While our results were surprising, just last month we learned that bottled water has even higher concentrations of even smaller particles called nano plastics. My work in this field of research started in the Great Lakes, the largest freshwater ecosystem on the planet, holding 90 percent of the

United States' freshwater supply and 20 percent of the world's freshwater supply.

Our economy and our Country are exceedingly fortunate to have this freshwater resource right in our backyard. Yet, over the five years that I sailed and sampled all five of the Great Lakes, we established a hard and sad truth. As the water flows from one lake to another, the amount of plastic within that water increases. Each Great Lake now harbors between one and five billion pieces of plastic each. Each lake has that much.

Ninety-seven percent of those plastics are what are classified as microplastics, whose origins are larger macroplastic items. The dominant degradation pathway of plastics is mechanical, not chemical nor biological. This makes plastics unique among other materials and is a primary driver for its ecological and human health impact. Plastics are synthetic. They are man-made, and as a consequence, they don't readily biodegrade, and so they linger in the natural environment.

As they linger, they are baked by the sun and pummeled by wind, water, cars, and the like, causing them to break into ever-smaller pieces. One macroplastic item can form millions of microplastics, which break into billions of nano plastics, particles so small they can easily move across the gastrointestinal tract, be carried by the blood, end up in our

livers, kidneys, brains, even crossing the placental boundary into embryos.

There are about 13,000 different chemicals used during the manufacture of various plastic products. Many of these are known to be carcinogens or endocrine disrupting chemicals, which mean that they mimic hormones, the chemical messengers of the body. By affecting the endocrine system, these chemicals within plastics are linked to fertility issues, including decreased sperm counts, as well as being associated with obesity rates, autism, and other developmental issues.

Understanding the impacts of the plastic polymers themselves is the real knowledge gap currently that initial studies have shown connections to inflammation, oxidative stress, Alzheimer's, and other neurological diseases.

While we don't know everything, what we do know is concerning. Water, the necessary elixir of life, is a primary means for the movement of micro and nano plastics into people. While wastewater treatment plants are fairly effective at removing plastics from wastewater, even those particles that are removed end up in the biosolids, which are frequently applied to farmland.

This application allows plastic particles within the sludge to be re-released into nearby waterways as runoff or move through the soil into the groundwater. Studies have found

microplastics within groundwater. Our study on tap water found an average of five and a half pieces of microplastic per liter.

Should one think that bottled water is a solution to plastic within tap water, it is not. Our study on bottled water found an average of 325 particles per liter, 58 times the quantity within tap water. Just last month, a new study found an average of 240,000 nano plastic particles within bottled water, nearly three orders of magnitude higher than our microplastic study. This study supported what our study found, which is we can't filter ourselves out of this problem.

What can we do? The problem of plastic pollution is multifaceted, and so are the solutions. I think the EPA plastic strategy, as well as the Break Free From Plastic Pollution Act, provide good starting points for discussions. Three solutions I want to highlight are source reduction and mitigation, extended corporate responsibility, and the creation of a national waste and recycling plan.

Thank you greatly for your time and attention. I look forward to answering your questions.

[The prepared statement of Ms. Mason follows:]

Senator Merkley. Thank you very much for your testimony.

Now, we will turn to our third witness. Welcome.

STATEMENT OF BRENT ALSPACH, P.E., VICE PRESIDENT AND DIRECTOR OF APPLIED RESEARCH, ARCADIS

Mr. Alspach. Good afternoon, Chairman Padilla, Chairman Merkley, Ranking Member Lummis, Ranking Member Mullin, and members of the subcommittees. Thank you for the opportunity to testify before you today on this important topic.

My name is Brent Alspach, and I am a Vice President and Director of Applied Research at Arcadis, a global engineering and consulting firm where I oversee a program that has conducted approximately $30 million in drinking water, potable reuse, wastewater, and stormwater research.

I also serve on the American Water Works Association's Technical and Education Council, which works to advance practices and technologies that produce the best quality drinking water for the public.

It is in this capacity that I offer my testimony as a representative of the AWWA community and a subject matter expert on microplastics and drinking water. Accordingly, I am currently the principal investigator on two related projects funded by the Water Research Foundation, Developing Strategic Consumer Messaging for Microplastics in Drinking Water Supplies, Project 5155, and Fate of Microplastics in Drinking Water Treatment Plants, Project 5185.

Microplastics is a category of emerging contaminant that

includes a wide variety of particulates with different physical characteristics, which may originate from the primary or secondary sources.

Primary microplastics are produced as small particles, microbeads, or nurdles, which serve as the raw material for manufacturing a wide variety of plastic products, whereas secondary microplastics are a product of the fragmentation of larger plastics, like plastic bags or bottles.

While generally characterized as measuring less than five millimeters in size, there is no formal scientific consensus on the definition of microplastics. Studies have shown that microplastics are nearly ubiquitous in the environment, having been detected everywhere from the upper atmosphere to the deepest ocean trenches, including potable water sources and treated drinking water supplies.

However, the science of characterizing occurrence in these supplies and understanding their impact while advancing quickly is still in its relative infancy, with many important questions remaining to be answered.

The most important step toward advancing this understanding is the development and refinement of standardized analytical methods. Along these lines, the California Water Resources Control Board has approved two analytical methods, which select water systems throughout the State will soon apply to evaluate

real world samples.

Although these methods represent an important step in understanding occurrence, further research is needed to develop analytical techniques that are increasingly reliable, efficient, economical, and able to detect plastic particulates at the nanometer scale. Such advancements will facilitate the implementation of broader, more reliable occurrence, toxicity, and treatability studies.

The limitations of contemporary methods of microplastics analysis notwithstanding, it is still essential to understand occurrence and treatability to the extent possible with the best science currently available. Using these practices, a wide range of studies have demonstrated the ability of many drinking water treatment processes in common use across the Country to achieve significant reduction of microplastics, commensurate with other types of regulated particulates.

However, if toxicity studies ultimately demonstrate that some subset of microplastics poses a health risk via a drinking water vector, it will be important for water systems to adapt and optimize treatment as appropriate.

The extent to which microplastics may contribute to adverse health outcomes is likewise the subject of ongoing research and likely various microplastic attributes. Consideration may include the size, shape, and material composition of the

ingested particulates, as well as the ingested quantity and the residence time in the human body.

Relevant human health effect studies are difficult to conduct, and such research has not yet established a clear indication that microplastics are toxic, a necessary precursor to any regulatory action under the Safe Drinking Water Act, which requires clear occurrence and health effects data. These statutory requirements help ensure that water systems can maintain high quality, affordable service in the context of their mandate to safeguard public health.

Accordingly, Congressional support for research in these areas would be welcomed by the drinking water sector. In parallel with this research, exploring and enhancing opportunities to divert the sources of microplastics from entering the Nation's water supplies could be valuable preventative measures.

Thank you again for the opportunity to provide testimony on this important topic. I welcome any questions that you may have. Additionally, AWWA will be conducting an informational webinar on April 10th entitled Microplastics 2024: Practical State-of-the-Science in Drinking Water. Thank you.

[The prepared statement of Mr. Alspach follows:]

Senator Merkley. Thank you very much for your insights and testimony.

I am now going to turn to questions. I am going to start with the Chair of the Environment and Public Works, Senator Carper.

Senator Carper. Thanks so much, Mr. Chairman. Welcome, one and all. I am going to ask the first question, I just want you to give me really short answers, okay? We will start with you, Dr. Brander.

You mentioned, I think, in your written testimony that the U.S. has the highest prevalence of microfibers in our drinking water compared to any other nation. That is pretty amazing. Why is that? Just very briefly, why is that?

Ms. Brander. That is a really good question. It may, in part, be because we buy an incredible amount of clothing, and a lot of this clothing is generated by companies that promote fast fashion. There have been studies showing that our consumption of clothing has increased rapidly over the past five to ten years, and that could be contributing, but I don't think the exact cause is --

Senator Carper. So if we just buy, maybe, less clothing, we could maybe make a difference here. What do you think?

Ms. Brander. Like others have --

Senator Carper. I say that with tongue in cheek.

Next question. In addition to our retrofitting technologies in our washing machines to capture microplastics from our clothing, are there other innovations that can reduce the amount of microfibers in our water systems?

I really like to find out what works and do more of that. If there are other countries and other places where they have figured out how to do this better and we could learn from them, what can we learn from them, and are there any actions that Congress should consider to reduce microfiber shedding? Thank you.

Ms. Brander. Sure. Is that an additional question?

Senator Carper. It is a two-part question.

Ms. Brander. Sure.

Senator Carper. But you only get paid for one.

[Laughter.]

Ms. Brander. Yes, fair enough. A nonprofit that I collaborate with in California is actually looking into solutions such as textiles that shed less, as well as textiles that are produced from materials like kelp, producing textiles from sustainable materials that can also capture carbon. So those are solutions that are both being looked into currently that could potentially reduce microfiber shedding over the long term.

Senator Carper. Anybody else want in on that second

question? What can we learn from others with respect to this challenge, this problem? Again, I would like to say, find out what works, do more of that. Anybody out there, in another country, maybe, that is doing a better job than we are?

Ms. Mason. I don't know if there are other countries that are doing better. I think that there are people looking into it. Patagonia is another company that is looking into it heavily as well.

So I think that there is some important science out there that is trying to understand kind of why the clothing sheds as much as it does, and are there things that we can do to mitigate that. Bio, natural-based polymers are another solution, although they still have the same chemicals that are used in them, and so that is still a concern, because as they degrade, they biodegrade, but they are still toxic.

Senator Carper. All right, thank you. Mr. Alspach, question for you, and maybe for our others. Are there any areas of research noted in the draft strategy that the Federal Government should prioritize, and are there any further topics for future studies on micro and nano plastics not included in the draft strategy that the Federal Government maybe should consider?

Mr. Alspach. Yes, I think probably the most important area that could require funding is the development of analytical

methods, as I mentioned in my testimony. Because, as several of the other speakers have mentioned as well, we really don't have a very good understanding about the occurrence of nano plastics in the environment and our water supplies, and until we understand that occurrence, we really can't conduct meaningful treatability or toxicity studies to really understand, in turn, how we should take action about microplastics.

Senator Carper. Okay. Dr. Mason, we are not going to let you get out of here without a question.

I think in your testimony, you described an extended producer responsibility policy as one of the most powerful tools that policymakers have to decrease plastic pollution, including the resulting microplastic pollution we see in our marine environment. Will you please expand on how extended producer responsibility policies can be an effective tool for reducing plastic pollution, and subsequently reduce microplastic pollution?

Ms. Mason. From my understanding of how they work, the companies are charged for the plastic that they utilize, that they produce. They are charged less if they choose a polymer that is more easily recycled, like polyethylene or polypropylene, versus something like polystyrene or polyvinylchloride that can't be recycled.

Obviously, if they switch away from using plastics at all,

they are not paying for it. That money then also adds into infrastructure for the recycling system, which right now, is being borne by the taxpayers, and hence, is consistently underfunded.

This is one of the reasons why the recycling of plastics is so bad, because we need better funding mechanisms to support the infrastructure around recycling. So this is a mechanism to provide that support for the recycling industry, while at the same time shifting the market to fewer polymers.

Right now, I mean, another issue we have with recycling of plastics is that there are thousands of different polymers that are on the marketplace. To recycle them, you have to separate them each from each other, and you can't do that through mechanical means. You would need FTIR, you need scanners, you need a different type of mechanism, and our current recycling infrastructure doesn't have that in place.

One of the reasons why we have such a hard time recycling plastics is the separation of the different plastics from each other. If we can reduce the number of polymers that are on the marketplace, it enables better recycling, and on top of that, you have a funding mechanism to support that recycling initiative. Then, you are using, you know, your roles to get the outcome that you want from the system that is in place, and that is ultimately what we can do.

As Congress, what you guys can do as Congress, is you have systems in place, but you can use your leverage, use your different levers in order to produce the outcome that you want. Right now, the recycling infrastructure is awful, so extended corporate responsibility is a good way to leverage to get the outcome that you are looking for.

Senator Carper. Thanks to each of you.

Mr. Chairman, my wife studied at the University of Tennessee, undergraduate fibers and textiles, and later worked for DuPont for 30 some years in the same business, and then taught as a professor at the University of Delaware, actually, courses that relate to this as well. I don't know how many people tune in and look at the reruns of our hearings, but she is going to be tuning in tonight, and sends her best.

Thank you.

Ms. Mason. Thank you.

Senator Merkley. Thank you, Senator Carper.

Senator Mullin?

Senator Mullin. You make me nervous that my wife is going to watch my hearings. She would scold me and correct me all the time. I love her, though, deeply, so if you are watching, they have been the best 26 years of my life, babe. Just wanted to put that one out there before I get myself in trouble.

Anyways, thank you guys for being here. I am sorry I came

in a little late. I had an opening statement to thank you guys for taking the time out of your busy schedule to inform Congress.

I think we can all say that the desirable outcome is not to have microplastics in our water, right? That is what we would love to have, but at the same time, when we are starting to look at these studies, what we always say up here is follow the science, and science always changes.

As a licensed operator to operate waste and drinking water facilities, I understand the challenges that our municipalities have to meet today's regulations, which is very challenging.

Years ago, we had a company called Mullin Environmental, where we did a lot of the water treatments. It is constantly changing, and the different makeups of the water makes different challenges. You can literally go two miles down the road and have a complete different makeup of water, that you have completely different challenges to make them compliant with today.

As we are moving forward, looking at microplastics, we have to be careful that we are not getting ahead of, as we would say, the science and burden these municipalities that are trying to meet today's regulations to chase something that we don't even know the conclusion of, if it is actually causing what harm, or if it is causing harm at all.

I just caution all of us to understand that we have a lot of research to do, and I think that is what you guys are doing, right? That is what everybody here, we are researching, and we are here, and we are searching for what we need to do, but we have to be cautious moving forward, too. By focusing so much on microplastics, which we should, I am not saying we shouldn't, we can distract what these municipalities are trying to do right now is make sure it is clean and safe and not causing cancers or what chemicals we are introducing aren't causing harmful reactions to the material that is already in the ground, like what we saw in Flint, Michigan.

I say all that because I want to make sure, as a committee, that we are moving with caution and we are going to actually pay attention to the science that is leading us down this path, which, once again, I repeat myself, thank you guys for the research that every one of you guys are doing.

I am going to call you Brent. I won't mess up on that one. Does that work?

Mr. Alspach. That is fine. Thank you, Senator.

Senator Mullin. Thank you, and you can call me Markwayne, so that way, we don't have to use formal titles, there. Given the significant infrastructure investment needed to improve and maintain the compliance with current regulatory requirements, if water supplies and regulators were to shift their attention to

microplastics, what other safety priorities might be impacted?

Mr. Alspach. I think, as you suggested, there are a number of priorities that utilities are currently contending with. A couple that come to mind that are most pressing presently, PFAS and lead. Both of those require significant amounts of attention and cost to utilities, which then is often passed on to their ratepayers, unless there are subsidies available to them.

Diverting attention to something, an additional contaminant, whether it is microplastics or anything else, would, by necessity, take some amount of energy, time, cost away from utilities meeting the regulatory requirements for things like that that we know are toxic and we know need to be addressed in a very expedient manner.

Senator Mullin. Just to hit on the lead exposure, too, I understand every time we introduce, most of the lead that we have in drinking water, they were already coated, and we used to use a really natural water filtration system.

When we started having to get into a more regulatory environment where we were cleaning up a different type of water, we had to introduce more chemicals, and those chemicals then had a reaction to a lot of the piping that we have in the ground today. And that is kind of my concern that we have today, because it erodes the protection coating that was over some of

the lead piping that was there, and then exposes us. We have now more issues.

We tried to solve one issue, and we caused another problem. And so, as I said before, we have to be really careful about the path that we are moving towards, because it can have a domino effect, especially small, rural areas where they just don't have the resources, which is what Senator Lummis and I, we represent rural areas.

We face this all the time in our rural communities. If they don't have the resources to just simply build a new water treatment plant, it just doesn't exist. Once again, thank you guys for being here, and with that, I yield back.

Senator Merkley. Thank you very much, Senator Mullin.

I am going to jump into a couple questions that I hope to get quick answers to, but I realize that is hard to do, because things are complicated, but a lot of people listening to this hearing right now are going, huh.

Senator Mullin. All five?

Senator Merkley. All five of them.

Senator Mullin. Six, it is six now.

[Laughter.]

Senator Merkley. And our wonderful audience here, and hopefully, our online folks as well.

Should I be getting a water in a plastic bottle? And I see

heads shaking no. But here is the thing: my understanding is, our paper cups, like the one Senator Lummis is drinking from at this moment, are also lined with plastic. My understanding is our aluminum cans are lined with plastic.

Over here, we have a blue, can you hold up your blue water bottle? I am not sure about that. If it is in fact the case that aluminum cans and paper cups are lined with plastic, and do they put off fewer particles, or should we be thinking just in terms of individual health? Is there some container other than glass that doesn't have a plastic lining?

Ms. Mason. Are you aiming this at whoever jumps in first? Is this a free-for-all?

Senator Merkley. Dr. Mason, please?

Ms. Mason. The coffee cups, because typically you are putting a hot beverage into that, is going to release more microplastics than if you were pouring a cold beverage into your container, which probably, if it is stainless steel, doesn't have a lining. Most reusable metal water bottles these days, most of them, do not have a lining.

Your soup at home usually has a lining; if you have orange juice, like I grew up on canned orange juice, yes, I remember, it tasted like metal because it wasn't lined with plastic. You have different extremes for sure, and I think there is more science that could be known on that, but preferring certain

metals, certain containers over others, I think would be better.

Senator Merkley. I don't want to extend the time too much; I only have five minutes, so I will just take your answer. That is helpful.

I heard, basically, stainless steel may be the way to go. I will, for the record, I will follow up with some other questions, because I would like to know if the amount of particles that comes from a paper cup lined with plastic or an aluminum can is different than those coming from a water bottle and so forth, but that is for the record.

I want to turn to the human health side of this. In your testimony, Dr. Mason, you referred to, did I hear you say myocardial damage? Ah, Dr. Brander. That is heart damage, I assume. Then also in the testimony, about the impact on sperm, on autism, on obesity, and Alzheimer's.

Are these simply things that we suspect, or are we able to have a scientific process now that has really kind of started to really give us insight on how much these particles are contributing to challenges of human health?

Ms. Brander. Just like we have done with other contaminants over many decades, we have begun using rodents as a model for human health for the study of micro and nano plastics. Recent studies are pointing to issues like cardiac toxicity, the potential for fibrosis, for example, in blood vessels created by

the presence of these particles.

In addition to those issues, there is also the potential for impact on the microbiome that has been highlighted by a few studies. In a study that we did at Oregon State that was published in 2023, we dosed drinking water with a low level of nano plastics, and mice were exposed to this drinking water for 24 hours.

Just after that 24-hour period, we saw a significant different in the diversity of bacteria in the gut of the exposed mice. You can imagine what that might mean over a lifetime of exposure. Those are findings that have been published by my group and others.

Senator Merkley. For those of us who don't follow all the health issues, microbiome, we are talking about the bacterial growth in your intestines, I assume, and you are saying just in 24 hours, a low dose, you said, not some high dose.

Tell me how, you mentioned the impact on human reproduction, on sperm counts. We know sperm counts have dropped enormously for men, obviously for men, but around the world. Are we confident of this link between plastics, and is it the plastics themselves, or is it other chemicals that have been put into the plastic for hardness, brittleness, flexibility, color, and so forth?

Ms. Brander. Really good question, because in some ways,

those are two separate issues. Being exposed to a plastic particle is a multiple stressor because you are being exposed to the chemicals, potentially, that are associated with the plastic, but also the particle itself.

A lot of the chemicals that are used in plastic, the 13,000 to 16,000 at this point, estimated, are endocrine disruptors and directly interact with hormone receptors, and that is shown to contribute to decreased sperm production and decreased fertility.

The plastic particles themselves, as Dr. Mason was saying earlier, they can cause oxidative damage. They can cause the production of reactive oxygen species, and I realize that is a lot of terminology, but long story short, that can cause cellular damage, and then tissue level damage if it gets bad enough. Those processes can also contribute to effects on reproduction, microbiome, other important endpoints.

Senator Merkley. Thank you very much. Senator Lummis?

Senator Lummis. Thank you, Mr. Chairman.

My daughter is a little obsessive about the containers that she uses in her house for my grandchildren, and I thought she was being a little obsessive-compulsive, and now I know she is not. This is a real thing, a real concern.

I want to try and bring it down, Mr. Alspach, to the water treatment level. Help me understand how we can do a cost-

benefit analysis that maybe a small water treatment plant in a community in Wyoming can get their head around and use to help them address this issue.

Mr. Alspach. You ask a very important question, Senator. I firmly believe, as I have indicated in my testimony, that we just need more research to be able to even answer that question. I don't believe, at this point, that a utility in Wyoming could do a meaningful cost-benefit analysis without much more information that informs what that analysis would ultimately tell them.

Senator Lummis. Okay, so are groups like yours thinking about that, getting ready to help maybe a small water treatment plant analyze the cost and the benefits?

Mr. Alspach. Certainly, the cost of treating for microplastics is something we could quantify. Whether it is to an extent that would be meaningful for health reduction, again, that is an open question, but they are particulates, and we do have a very good understanding about how particulates, for the most part, are removed. Although microplastics have some different properties than other particulates. But we could quantify that for any utility and give some indication of cost.

Again, that said, there may be other particulates on the nanoscale that we cannot yet detect and don't have any understanding, really, about how efficacious treatment processes

are for removing those particulates.

Senator Lummis. Based on what you know now about this subject, how would you tackle it from a policy point of view? What would you do first that would have the biggest bang for the buck, and then scale it down from there?

Mr. Alspach. Yes, that is also an excellent question. I guess I would give some credit to the State of California, which I believe is doing a very good job of approaching this topic. I believe when the State passed its bill to give the regulators a mandate to look at this process, they didn't go in with the foregone conclusion that something should be done about microplastics, but with an open mind that it is an important question that needed to be addressed.

With that in mind, they went and developed a definition of microplastics, followed by methods, again, which have their own shortcomings, but nevertheless, are standardized to the best of our ability at this point in time, and with those methods in place, they are going to look at source waters to try to understand the occurrence.

With that, hopefully more health effect studies will be done in parallel, and then ultimately, when their monitoring program has run its course, we hope there will be enough information between the occurrence data, the treatability data, and the toxicity data to understand whether or not microplastics

need to be looked at in a drinking water treatment context.

Senator Lummis. Okay, I see the gentlewomen on the panel, your co-panelists, nodding. Could you address the same issue?

Ms. Mason. I think he makes a valid point. I think real solutions to this problem are much more upstream than the wastewater treatment or the water or wastewater treatments.

That is not where you tackle it. You don't tackle this problem when you are dealing with something that is nanosized. You deal with it when you are talking about something that is big.

So that is why I point to source reduction and extended corporate responsibility and a waste and recycling plan. There, you are talking about macro items that are easy to gather and quantify and obtain, and you are reducing what is ending up in the water, the occurrence, and you are not looking at the water treatment facilities, telling them they need to clean it up, but I can keep doing whatever it is. I want to go into a coffee shop every morning and getting my latte in my plastic cup and then throwing it on the side of the road, the problem is that, right?

The problem is that when it is at the macro level, and that is when you really solve this. You always, when you are looking at a problem, you look as far upstream for a solution as you can. That is where the real solutions are.

Senator Lummis. Dr. Brander, would you like to weigh in?

Ms. Brander. Sure. I would say I completely agree with the comments of both of the other panelists. Source reduction is absolutely what we need to aim for. That is why the problem of plastic pollution is being discussed at a global level right now at the U.N., and that is where the focus is, focusing on reducing the number of polymers that are being produced, simplifying, chemical simplification, and reducing what we are putting out there.

Because once we have these nano-sized particles in the environment, you can't go out there with a vacuum cleaner and remove them from the environment. We really need to start at the larger scale, at the macro scale, to get at this problem.

Senator Lummis. This glass is made out of a natural trona. There are only two places in the United States that have natural trona mines. They are Wyoming and California. So, for my Chair and his Ranking Member, let us all use more glass from Wyoming and California.

Mr. Chairman, I yield back.

Senator Merkley. Thank you very much, Senator Lummis, and from Wyoming to California, we will make that transition.

Senator Padilla?

Senator Padilla. Thank you, Mr. Chair. I wanted to just acknowledge some of the questions and some of the work that

Senator Lummis and I are doing together, not just on addressing, we have talked about clean water, the need for safe water, but also water affordability and how a lot of rural communities or smaller agencies are able to finance these upgrade of infrastructure to address some of these issues.

Since you invoked the name of my State that I am proud to represent, let me brag a little bit more on what we are doing in California. I am proud to represent the State that tries to lead the Nation when it comes to environmental policy, as Mr. Alspach can well attest.

Plastics are certainly no exception. In California communities, plastics are pervasive, with single-use items like shopping bags acting like tumbleweeds when you find them in beaches and in parks, and frankly, just regular neighborhoods. That is why in 2014, the State of California took a step when it passed my first attempt at a statewide plastic bag ban. But since then, California has continued to lead on landmark plastic legislation like the current SB 54, which shifts plastic pollution responsibility from consumers to producers and bans Styrofoam in cities like San Diego and Los Angeles.

Now, California continues to pave the way in plastic monitoring. In 2022, we have been discussing this, the Ocean Protection Council released the first statewide monitoring program to manage microplastics. The roadmap includes setting

standards for plastic levels in drinking water and testing for these compounds in certified labs across the State.

I know our witnesses are very well aware of the work, but I share that with my colleagues and for the record to tee up the following questions. Number one, Dr. Brander, given your previous work with the OPC, what lessons can other States and the Federal Government learn from this pioneering monitoring program?

Ms. Brander. Absolutely, thank you for the question, Senator. I will mention that Oregon has also enacted an extended producer responsibility bill and has banned Styrofoam. I think that begins next year, so it is really --

Senator Merkley. Is it better than California's?

[Laughter.]

Ms. Brander. We will get back to California. From the OPC experience, what I think was critical there was that both scientists and stakeholders were involved from the beginning. That is really where we need to begin, I think, in every State, every discussion of this huge challenge.

In terms of involving scientists and stakeholders early on, I think that helps with the issue of people feeling like scientists are giving directives when we don't necessarily have the responsibility or the challenges of regulating a new contaminant on the ground. So I think that was really

important.

Then, the integration of all of the agencies across the State was incredibly impressive. Working with the Water Board, which is, of course, California's EPA, their Southern California Coastal Water Research Project, so many important agencies that were able to sort of cut down on the barriers and any silos that existed and able to work across any barriers that previously existed. So I think that was incredibly important as well. I think it is a wonderful example to other States.

The challenge to other States, I think, is the availability of resources and being able to compile enough resources to tackle such a giant challenge.

Senator Padilla. We certainly commend the State of Oregon for that being up.

Ms. Brander. Thank you.

Senator Padilla. I encourage others to do, as well.

Dr. Mason, can you expand on the challenges that labs face in monitoring plastics in water, especially at scale?

Ms. Mason. Brent did a great job of kind of mentioning this earlier, but with plastics, the techniques that exist currently are very time and people intensive. As we go to smaller particles, which are a bigger concern when it comes to human health impact, that adds onto it an additional layer with regard to the analytical technique.

The study that came out of Columbia and Rutgers University on bottled water was developing a new Raman spectroscopy technique that allowed them to analyze nano plastics, and not just to see that there was a particle there, but to say that yes, it is plastic, and this is the type of plastic that it is. That was critical. We haven't had that technique until January of 2024, but that is one technique, and it is really expensive.

We have the analytical abilities to analyze for particular plastics and identify them, and that is a huge expense on top of the fact that right now, we don't have an automated way to go about pulling microplastics out of water, so it is really human intensive, time intensive, and expensive.

Senator Padilla. Thank you. I know my time is up, Mr. Chair. I just have one follow-up question for the Californian on the panel. Just briefly, Mr. Alspach, can you tell the committee a little bit more about the two methods that the California State Water Board has approved?

Mr. Alspach. Sure. The two methods are infrared spectroscopy and a Raman spectroscopy method. The major difference between those two in terms of practical application is the resolution, which is 50 microns for infrared and 20 microns for the Raman.

That is important because the smaller you can go with your resolution, the better able to detect those nano plastics, which

are critical for our understanding about this issue in a more comprehensive way.

Senator Padilla. Thank you all very much.

Senator Merkley. Thank you, and thank you for California's work on this issue.

Let's turn to another ocean State, Rhode Island, the Senator from Rhode Island, Senator Whitehouse.

Senator Whitehouse. Thank you very much, Senator Merkley. Thank you to all of the witnesses. This has been a very helpful and productive hearing. I always appreciate it when a bipartisan panel can produce so much consensus and agreement on a particular issue. I thank you for all the work that has led to that being the case today, particularly you, Chairman Merkley.

The University of Rhode Island has done a study recently looking at the top five centimeters of the sediment in Narragansett Bay, which is our main resource and geographic feature. We are loaded with more than 16 trillion pieces of microplastic, which if we could sort it all out from the sediments around it, would be 1,000 tons. We also try to grow quahogs in that sediment, and catch fish that feed off of that sediment, and so forth. So there is a pretty distinct likelihood of transit, particularly of nanoparticles, up through the food chain. This has a real Rhode Island resonance to it.

One of the things that I have been working on is trying to keep tabs with the U.S. effort in the U.N. negotiations that were discussed earlier, and I am interested in hearing your recommendations to the U.S. negotiators. Assuming that the Senate schedule allows, I will be going up to Ottawa for the next meeting. Then, there is the Our Oceans Conference coming up in Greece, which will, I am sure, have a fairly significant piece on this.

I remember when President Trump was all excited about getting plastics out of the ocean and mad at China for dumping it all and all of that, but every time you actually read a story, the story was all the other nations of the world complaining that the U.S. was the laggard, that we were the anchor that they had to drag, that of all the countries in the world, we were least productive, helpful and contrastive in those international negotiations, so that wasn't so great.

What would you give, what message would you like me to convey to the negotiators when I go and harass them more about what the key points are that you would judge as being success points or failure points in those negotiations?

Dr. Brander, let me start with you.

Ms. Brander. Sure. Thank you, Senator Whitehouse, for the question.

Senator Whitehouse. I will just interrupt to say, I take

it as a given what Dr. Mason said that bigger is better. You want to get it out of the system before it has become nanosized, but go on around that.

Ms. Brander. Absolutely correct. I am a member of the Scientists' Coalition, which is a group of international scientists that is advising the delegates to the U.N. negotiations.

Senator Whitehouse. All of them? You are advising the entire delegate pool, not just the U.S. delegation?

Ms. Brander. That is correct.

Senator Whitehouse. Correct, yes. Go ahead.

Ms. Brander. Yes. A lot of scientists from Europe and Asia and other parts of the world

Senator Whitehouse. Thank you for that.

Ms. Brander. Sure.

In terms of the main critical issues, really, chemical simplification, so reducing the enormous amount of chemicals that are used in the manufacture of plastics. I think I have already quoted the 13,000 to 16,000 number. That is really one of the biggest problems that we need to tackle. Simplifying the number of chemicals that are used will make circularity, which is one of the biggest goals of these negotiations, more feasible. Because right now, given the number of chemicals that are contained in each of those plastics --

Senator Whitehouse. It is highly improbable.

Ms. Brander. That is right, and then the new cocktails that are created from recycling them is a huge challenge.

There was a recent paper published that estimated healthcare costs from exposure to those plastics-associated chemicals in the U.S. is about $249 billion annually, so not a small number. That I would say is one of the biggest challenges, as well as potentially banning polymers that are particularly problematic, like PVC and polystyrene.

So chemical simplification, polymer simplification, a better transparency in terms of corporations making data available on the composition of their products.

Senator Whitehouse. With, for instance, a registry that anybody could go and look to?

Ms. Brander. Yes, a registry. An international registry has been proposed.

Additionally, there is a huge environmental justice issue here. Although these practices have been reduced, plastics are still being shipped to countries that don't have the waste management capabilities to deal with them. So that is another, the environmental justice, human rights issue is a huge overriding issue.

I think what the feeling is on the perspective from the U.S. is that there is a lot of support for fossil fuel companies

that are aiming to shift their business from producing fuels to producing plastics, right?

Senator Whitehouse. Right.

Ms. Brander. We know natural gas. That, I think, is one of the biggest challenges in the U.S., is that the perception, that we are supporting this shift in business strategy of fossil fuel companies to producing more single-use plastics.

Senator Whitehouse. Well, the Chairman is familiar with my observation about the fossil fuel industry, that they have essentially two business strategies. One is to produce fossil fuel, and the other is to control Congress and manipulate politics so that they can do so, violating the laws of economics that would otherwise require them to put the price of their pollution into their product. Milton Friedman is scowling down at them.

Chairman, it is up to you. I have gone over my time already, if you wanted to allow the other two to answer, or if you want to wait for a second round, I am at your disposal.

Senator Merkley. If you have additional to answer on this question, and then I do have more questions, and I suspect you might as well?

Ms. Mason. I just support what she said.

Senator Whitehouse. She covered it?

Ms. Mason. She covered it, yes.

Senator Whitehouse. Mr. Alspach?

Mr. Alspach. Likewise, I am not nearly as familiar with this as Dr. Brander is, so I appreciate her comments.

Senator Whitehouse. Okay. I will flag one last thing, which is that there is, Unilever, it is quite a big company that we have worked with for a long time, and they have come up with a proposal that I think kicks in this coming year, where it will be their pledge, their plan, to remove from the ecosystem a pound of plastic for every pound of plastic that goes out into the world, which among other things, creates a market for that plastic.

To go to the places, to your point, Dr. Brander, about economic justice, to the places where this stuff is piling up so that they are knee-high wrack lines of plastic along shores and you have to push your boat out through floating seas of plastic to get out to clear water, suddenly, it makes a lot more sense to clear that up. Even if it is not being properly and fully recycled, at least it is out of those people's immediate experience.

And to put money behind that, to be able to buy that waste plastic in order to make good on your pledge, seems like sort of the corporate front line on this, too. I hope American companies take the lead, follow, and match that.

Thank you, Chairman.

Senator Merkley. I was thinking about a couple years ago, when the Potomac River flowed over the walking path south of the U.S. Marines Monument, I noticed people out along the trail with these little pliers picking up. I got down and looked, and in any square foot, you could see like, 100 or 200 pieces of little plastic, indicating to me how much plastic there was in the Potomac River as it flushed out to sea, just a massive amount. These were the visible version of the world.

Then, I was also thinking as you were talking back when I was developing affordable housing and the spec plans called for copper pipe, and the contractor suddenly brought in plastic pipe. I said, wait, wait, wait, it is not specced that way. It is specced for copper.

But I didn't have any indication, I had not thought about plastic as a pollutant to drinking water. Instead, I was concerned about whether a plastic pipe would hold up. They brought in a demonstration where they took a torch to the plastic pipe and showed it didn't melt, and so on and so forth, that it had all been cleared. It was hugely beneficial for human health, and now I am going, hmm, maybe not.

You just mentioned PVC. There is a slightly different version that is used for water supply pipes, but are water supply pipes made of plastic a good idea? If either of you have an insight on that.

Ms. Mason. You are going to put me in the hot seat, thanks. No.

Senator Merkley. Okay, no.

Ms. Mason. Short answer, no, not a good idea. Beyond Plastics, actually, has a really nice article out, a whitepaper, excuse me, out on this topic.

To be honest, I am not sure that it is the first thing that I would tackle with regard to this issue. But it is a concern, and it is a legitimate concern. As pipes are being replaced because of the issues around lead, it would be preferable to replace them with copper over PVC or something similar.

Senator Merkley. As we are talking about this, it seems to me there is just a huge amount of research that needs to be done here. In different scenarios, different types are plastic are shedding different amounts. Different types of containers are shedding different amounts.

The type of plastic that is being shed is different. The ingredients that have been added to the plastic formulation for other qualities are different. For us to try to get a handle on the underlying question raised by our colleague from Wyoming of where do you get, that produce the most results per buck, if you will.

Is NIH fully in gear in terms of investing in our health, understanding our health research? You mentioned, Dr. Brander,

mouse models in a controlled setting where you can really measure the impact much more. You mentioned gut health being measured. But are some of the other impacts like obesity, Alzheimer's, heart disease, autism, sperm counts, are we starting to have studies of mice that start to give us a kind of really clear understanding of the health impacts?

Ms. Brander. Sure. I will say that the National Institute of Health did issue a statement, I believe it was about a year ago, saying that more resources were going to be devoted to better understanding the impacts of micro and nano plastics. That being said, most of the research that has been done on mammalian models, rodents, mice and rats, so far has been done in Asia or Europe, because there is more funding in those parts of the world for studies on human health.

It is still, I would say, in the U.S., studies using rodent models are still in their infancy. We have really just begun in the U.S. on answering some of those questions. But we do have data from other parts of the world that suggest reproductive, microbiome, digestive effects, and cardiovascular effects.

Senator Merkley. I think that is extremely important, because otherwise, any given observation on human health, there are so many influences, so we need that laboratory setting to gain understanding. Of course, that is why we have the National Institutes of Health, is to help invest in significant human

health issues, and this is an area that really is in the beginning phase of understanding that there is a big connection here to be explored.

So, we are closing in on the end of a vote, but I really appreciate all three of you raising the issues.

Is he on his way here to the committee? Do we have staff for Senator Sullivan? How far out? How much time do I have on the vote? We will see if I can stall a little longer, but I can't miss the vote. It is not really stalling, because there is so much to be explored here.

Mr. Alspach, you mentioned developed systems for measuring the amount of micro and nano plastics. That seems critical to our understanding here of how particles are shed and how much gets into us. Dr. Brander and Dr. Mason, is it just in the last couple years that we have really had the tools to start to understand this shedding process and the amount that is getting into our human bodies?

Ms. Brander. I really think that it is just over the past couple of years that we have started to better understand human exposure and human occurrence. In part, that is because the technologies to measure nano plastics are slowly coming online, things like pyrolysis, GCMS, which is a fancy way of saying you are pyrolyzing a sample and measuring the mass of particles that might be in there.

Yes, it is a new area of study, and I think we are also just starting to understand how easily those particles can translocate and move within our bodies, as well.

Senator Merkley. Should we quit putting plastic pacifiers in our babies' mouths?

Ms. Brander. Probably, yes.

Senator Merkley. Okay.

On that, Senator Sullivan has worked really hard on environmental ocean issues. As another ocean State Senator, you see a dominance of ocean State Senators raising issues and concerns here. Welcome, and we will turn it over to you. I may have to have you close up if I have to run to vote, if you wouldn't mind.

Senator Sullivan. [Presiding.] No problem. Thank you, Mr. Chairman, for holding this open for me, a really important hearing.

I know that Senator Padilla was in here. He and I have been working on this issue before he even was a Senator, in a bipartisan way. I want to thank the panelists.

For those watching, we had a big announcement in Alaska last week. Hopefully, you heard about it. I want to make sure the Chairman hears about it before he leaves. In our Save Our Seas 2.0 legislation, that was legislation that a number of us got behind, Senator Whitehouse and I were the leads on that, the

most comprehensive ocean cleanup legislation ever from the Congress.

One of the things is a Marine Debris Foundation. The Marine Debris Foundation is a Congressionally chartered foundation that focuses on ocean cleanup, plastics, and other marine debris. Last week, I had the great pleasure of announcing that the Marine Debris Foundation would be headquartered in Juneau, Alaska in collaboration with our universities there that do already great ocean research. This will be a public-private partnership that can accept private dollars.

There is a lot of interest in this in the private sector. We want to make sure you guys all get a chance to come out as this foundation gets bigger, more prominent on the issues that we are all talking about, ocean debris, ocean plastics, and what we can do to keep our oceans clean.

This is a global challenge, I like to say, but also a solvable one, because we know that the estimates are anywhere from 60 to 70 percent of all the ocean debris in the oceans in the world come from a number of rivers, the estimates are ten or more, in Asia and Africa. So it is very solvable.

Let me ask each of you, you know there is this idea of what we have banned, plastics or other things. Here is the big idea. By the way, this Marine Debris Foundation has as one of the

elements in the law that we will have a Genius Prize that focuses on public-private university innovations in terms of technologies that can dramatically impact keeping our oceans clean.

One of the ideas I have always been pressing for is this idea of, you have a plastic bottle, somehow it gets in the ocean. You don't want it to be, but it is. It has water, it is how people drink clean water.

That bottle right now, they don't fully biodegrade. That is why we have microplastics in the water, but I know there are chemists in America who are working on the potential of a plastic water bottle to fully biodegrade. That would be a huge innovation. It wouldn't be coming from the government, but that is something that this Marine Debris Foundation, now in Alaska, with its mandate of many things, but one of which is a Genius Prize, would be something to undertake.

Let me ask all of you, what do you see, and since the Chairman left, I can ask questions as long as I want, so this is kind of nice, there is no one else waiting for me. What do you guys see as the technological advancements and innovations that can be leveraged to either detect microplastics or just get rid of them when they are in the ocean?

I will just ask each of you on that really important question. What do you see, and you are all top professors,

applied researchers, this is the key, right?

A lot of times, we in the Senate, oh, the government is going to do this, the government is going to do that. My view is, this challenge, which is going to be solved, it is solvable, it is going to be through private sector innovations. This new Marine Debris Foundation, based in Alaska, is going to help encourage that.

Why don't we start with you, Dr. Brander?

Ms. Brander. Sure. That is really encouraging.

Senator Sullivan. Have you guys heard of the new Marine Debris Foundation in Juneau, Alaska? I hope you have. You have to come out and visit it. We will wait for it to get a little bigger, but it is exciting.

Ms. Brander. It is really exciting that that foundation has been created. I agree that private sector solutions are needed, but I think that needs to happen under an umbrella of some regulation that allows for things to happen at an equitable level and at a similar speed nationwide, rather than happening State by State or region by region.

In terms of the development of a plastic bottle that could fully degrade --

Senator Sullivan. Or any other technological innovation that, if you had a magic wand, you think could be really important. That is one idea I have been pushing, but we want

other ideas, right? What are the other ideas? This foundation is going to help encourage all of this thinking.

So, you are three of the top minds on this. What is your magic wand moment in terms of a technological innovation that could be really helpful?

Ms. Brander. I think if there was a technological innovation that could better advance chemical simplification in some of these plastic products that were being made, that would greatly reduce the number of toxic compounds that are being released into the environment that we are being exposed to.

Currently, we have been relying on so many different combinations of chemicals that even if something is fully biodegrading, that doesn't mean that it is not releasing those toxic compounds into the environment. So really the toxicity of the polymers and the products that are being used, or the chemicals that are being used to produce those products, needs to be tackled first before we aim at making things biodegrade faster or biodegrade completely.

Senator Sullivan. Okay, good. That is a great answer.

What about you, Dr. Mason?

Ms. Mason. I concur with what you said, which is probably no surprise. We have been on the same page this whole day.

Senator Sullivan. Think big here. This is the moment, right? Any big innovation that, even if it is way out there,

that you think, if somebody figured it out, would have a giant impact.

Ms. Mason. I think the problem needs to be, you missed earlier, which is fine, I am not criticizing you, I am just stating that, like earlier, I mentioned that the solution to this is before you get to the oceans and other freshwater systems, by the way, because this isn't just an oceans problem, it is before you are dealing with microplastics and nano plastics.

So, really solving it as almost the litter, before litter problem is the real innovation that needs to happen with a focus on the biggest piece of the market is packaging, and so thinking about alternatives to the packaging. I think there are some alternative, second-generation polymers that are being developed, and I think that that is encouraging to the point that Dr. Brander was making, the chemicals that are used in those are still an issue, and so those chemicals need to change.

I think those are especially exciting for something like cars or refrigerators, things that where the use of plastics, you know, cars are much more fuel efficient because of the plastics that have been used in them. It is not a place that you can, you are not going to just eliminate the plastics, but coming up with a biodegradable, nontoxic plastic would be really helpful there. I think that that is the future.

They are also looking at hydrogels as a way of removing nano and microplastics as a potential. But I think cleanup comes secondary to really solving the problem upstream from that.

Senator Sullivan. So, the Save Our Seas 2.0 Act focuses a lot, hopefully you have read it and seen it, focuses a lot on the upstream, so I don't disagree with you at all on that. Both of you are kind of saying biodegradability is important, but less toxicity is equally important. Okay? Good, great.

Mr. Alspach, what about you?

Mr. Alspach. Thank you. I appreciate the information about Juneau, and I would take any available opportunity to visit Juneau anytime I can reasonably do so.

Senator Sullivan. Good. It is a beautiful place. I just spent the last three days there, and it is wonderful, and they are very excited about this new foundation and the leveraging.

We have a huge NOAA research facility in Juneau, we have the University of Alaska, Fairbanks, which has their College of Fisheries and Oceans, the University of Alaska Southeast. So it is kind of becoming a big research hub on fisheries, on oceans, and this will add to that, which will now be on ocean debris.

You guys are all invited. In fact, everybody here is invited. Come on up to Alaska. We would love to have you.

Mr. Alspach. A couple points to your question. First,

with respect to the biodegradation of something like a water bottle, I believe that the technology to do that probably already exists in a number of facets, but the problem is not the technology, in this case. It is the scalability of that technology for industrial processes that make it economical.

I believe the private sector can do that, as long as there is an economics market to make an incentive to do so.

Senator Sullivan. Don't you think, if you are the company, and I have said this a lot, if you are the company that actually, maybe it has already happened, but if you are the company that has cracked the code on less toxicity and full biodegradability, A, I think that would be very good for the environment, but B, that company is going to probably profit, which, as I have said, we are a capitalist society.

I think that is how you drive innovation. That is fine with me, right? So, that is a win-win, right? You help the environment, maybe you help build a company. The workers benefit, shareholders benefit. So it seems to me it could be a potentially very lucrative place to actually be successful, not just for the environment, but for the economy, as well.

What do you think?

Mr. Alspach. I agree, unless they need to make it scalable so that it is able to be accomplished, correct. But in terms of my wish list for technology --

Senator Sullivan. Yes, wish list.

Mr. Alspach. I sincerely appreciate that question a lot. We have talked on this panel a lot about nano plastics and the lack of methods to detect nano plastics. There is detection, period, and then there is making the method economical and reliable and efficient, and things that make it usable for us to actually detect nano plastics in the environment and in water supplies.

We will talk a little bit about, in my field, about the evolution of sensor technology and how if we were able to quickly, with some kind of, and I will use this word colloquially, Star Trek type technology, to scan a water sample or scan an air sample or a soil sample and detect the nano plastics that are present, that would give us a little --

Senator Sullivan. Does that technology exist right now, or not?

Mr. Alspach. To the extent that I have described it, no, but this is actually where I am going with this point. When I have conversations about these types of sensors with people in my field, they will says, well, we are so far away from that. That is not feasible.

But we tend to think, as a society, in very myopic terms about what is possible and what is not. If you had asked something in, say, 1875 if we could put a man on the moon, they

probably would have said there is no way that is ever going to happen, but yet, we did it.

So, I think we shouldn't limit ourselves based on our knowledge of what is possible today what might be possible tomorrow. I feel like one way to accomplish that is to encourage cross-disciplinary collaboration among researchers and industry, because there could be limitations on a method to detect nano plastics that an industry that is not even thinking about nano plastics might have a solution for.

All you need to do is connect those dots to get those people talking to each other, and they might find they have a mutual solution that can solve the problem. If more of that cross-disciplinary collaboration occurs, we may solve that problem maybe before I retire, as opposed to when my daughter retires.

Senator Sullivan. Good. Well, look, what we are trying to do in Alaska, particularly in Juneau on this issue, is this kind of cross-disciplinary collaboration. We have the institutions right now, as I mentioned, between NOAA, our research universities, and this new foundation, the Congressionally chartered Marine Debris Foundation, to do that.

Then the idea in the legislation with our Genius Prize, is to also do exactly that, to encourage people to press the limits on what they think is feasible from a technological standpoint,

and then bring that period much sooner. To your point, 1875, getting to the moon less than a 100 years from that date is pretty remarkable.

Great. Any other thoughts on the technological side before I gavel out here, from our witnesses? It is a really important component. You guys have answered the questions really well.

With that, I want to close by again thanking our witnesses for appearing today and sharing their knowledge on microplastics. I would also like to thank Senators Merkley and Padilla and Mullin and Lummis for being the chairs of this joint hearing, which is important, on this important topic.

Before we adjourn, I ask unanimous consent to submit for the record a variety of materials that include letters from stakeholders and other materials that relate to today's hearing. Without objection, so ordered.

[The referenced information follows:]

Senator Sullivan. Additionally, Senators will be allowed to submit written questions for the record for all of you through the close of business on Tuesday, March 12th. We will compile these questions for the record and send them to our witnesses, and we will respectfully ask all of you to try to reply to those no later than March 26th, Tuesday.

With that, again I want to thank the witnesses. We have a really good crowd here. It shows you the importance of this very important topic. I think we made some good progress today.

With that, the hearing is adjourned.

[Whereupon, at 4:31 p.m., the hearing was adjourned.]