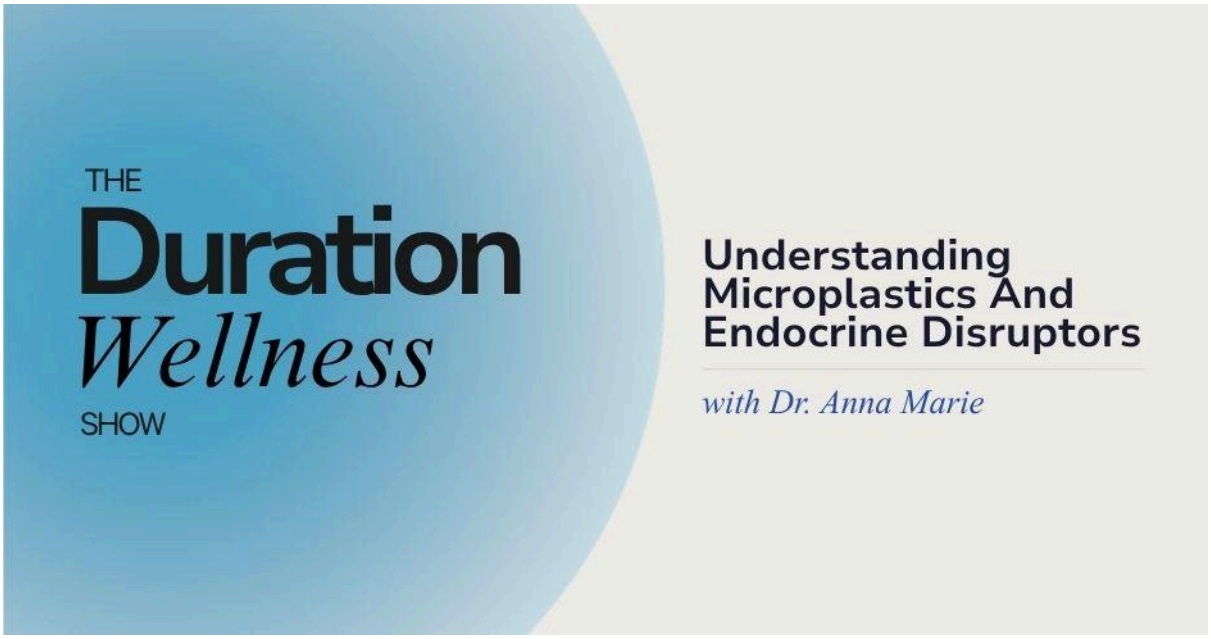

Many people use the terms Microplastics and Endocrine Disruptors synonymously, but they're actually distinct threats to your daily wellness. Dr. Anna Marie McCarthy joins us to break down how these synthetic particles and chemicals infiltrate our bodies through water, food, and even the air we breathe. We discuss the shocking clinical data showing their accumulation in human organs, including the cardiovascular system and the brain. You'll learn the difference between short-half-life chemicals that leave your system quickly and persistent forever chemicals that stay for decades. We outline practical, medically backed steps to reduce your daily exposure and safeguard your cellular health. You don't have to live under a rock to protect your family from these invisible environmental stressors.

Watch the episode here

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Understanding Microplastics And Endocrine Disruptors With Dr. Anna Marie

Welcome to the show. I am Dr. Anna Marie, a board-certified internal medicine physician with a Master's in Public Health and a love of preventative medicine. We are back for another episode. This episode is going to be all on microplastics, endocrine disruptors, what evidence there is on them, and what we should do about it. It is a big topic. Again, this is an overview, not getting into the super weeds of everything, but I do think that it is important for people to understand microplastics and endocrine disruptors.

Defining The Threshold Between Microplastics And Chemicals

To start off with, a lot of times I think people use microplastics and endocrine disruptors synonymously. I wanted to know if they are actually the same thing. No, they are not. They are separate. Microplastics are the actual plastic particles, and endocrine disruptors are chemicals. The reason a lot of times people use them synonymously is that there is overlap. A plastic particle can act as a carrier for these chemicals. A lot of plastics contain or interact with endocrine-disrupting compounds. That is why there is a lot of overlap with these, but they are actually separate.

Microplastics are the particles, and endocrine-disrupting chemicals are the actual chemicals, but the plastics can carry the chemicals. What are microplastics? These are basically plastic fragments, fibers, or particles with at least one dimension measuring less than 5 millimeters. There is also a category of nanoplastics. There is a little bit of a debate in terms of the precise upper size limit, but overall the consensus is that it ranges from one nanometer to a thousand nanometers in size.

Nanoplastics act a little bit differently in terms of that they are so small that they can actually get into cells. There is a lot of theoretical risk with them. This includes respiratory risk, GI risk, reproductive toxicity, cardiovascular effects, immune modulation, and there is a lot of emerging data that does support epigenetic effects. That basically means your body has this genome, but then you can have these environmental factors that will turn genes on and off, which can be very concerning.

It can be a trigger for inflammation and autoimmune disease. That is one of the concerning issues with that. Now it can be really hard to tease out in terms of exposure to micro and nanoplastics. A lot of studies do look at what we call micro and nanoplastics. They just combine them together. Where are you getting this exposure? There are three main routes. One is ingestion, like food and water. Another one is from inhalation, from the air. The third one is dermal contact, from your skin.

By far the biggest exposure is from ingestion. That is one of the biggest pathways, and then after that is inhalation. Water. Drinking water is one of the biggest exposure sources. Bottled water is something I think people are becoming more aware of, but that has a significant risk in terms of microplastic exposure. It makes sense that if you are drinking out of a plastic water bottle, you are going to get migration from the plastic bottles, especially with mechanical stress.

Tweet: Microplastics act as physical carriers for endocrine-disrupting chemicals, magnifying their impact on our metabolic and reproductive health.

If you are squeezing the water bottle or it is getting tossed around in the back seat, all of that places this mechanical stress on the water bottle that increases the microplastic release from there. Also, UV exposure and heat contribute to this. You might be grabbing a cold water bottle from the gas station, but you do not know, in terms of travel time, how long it was out in the heat in the truck or how long it was out in the heat in the storage facility.

Are you leaving your water bottles in the back of your trunk and then whenever you need it, you go and grab it? It has gotten this exposure in terms of heat. All of that then breaks down into even more microplastic exposure. Also, consider just how old a water bottle is. The older that the plastic water bottle is, the more release there is. Repeated use also increases release, which makes sense because again, you are going to have that movement in the water bottle. All of that can increase how much microplastics you are getting when you are drinking out of water bottles.

Concentrations can range from 1 to 10,000 particles per liter. That is a pretty significant amount. Tap water can be another area. A lot of people do not realize the municipal water supplies unfortunately do contain microplastics, and that is just from environmental contamination. They do not have the filter systems in place for these treatment plants to filter out the microplastics.

Adults can consume up to 41,000 items by drinking water a year alone, which is wild. Food, of course, is a huge source. I think pretty much everywhere you look, food is packaged in plastic. There are plastic containers, bottles, and packaging materials. These all release microplastics, and again, that can be through mechanical stress and through temperature changes. How often are you heating up things in plastic containers? There is also just the general breakdown.

There are other sources like fish. Seafood is swimming around in more polluted waters, unfortunately, and so fish, shellfish, and some other marine organisms can actually accumulate some of the microplastics. Table salt is another factor. People do not think about this, but a lot of sea salt is in this contaminated water. Now we see that this also has microplastics. Adults can consume up to 51,000 microplastic items just from table salt, which is wild. Food processing and production also contribute.

Hidden Sources Of Daily Plastic Exposure

Obviously, a lot of processing plants have to use plastic in some of their materials, so then that can be another source. Microplastics have been detected in meat, in milk, drinks, salt, fruits, vegetables, and so many processed foods. Another source is inhalation. You have to think pretty much all of your synthetic textiles, like polyester, nylon, and spandex, are plastic. You get exposure to that from any of those sources. Dust and building materials also contribute to exposure. In terms of inhaling things outside, one of the biggest things is tires. Tires are a huge source.

What is growing now is turf. Turf has skyrocketed in popularity, and we are actually going to talk about it more in depth later, but it is pretty concerning in terms of the exposure. Specifically for microplastics, synthetic turf fields release airborne microplastics through mechanical fragmentation during use. There was a 2026 study that found that kids especially had heightened vulnerability just because of their physiology and activity patterns on these surfaces. It makes sense that kids are running around. They are diving, they are jumping, and all of that is going to break some of those particles.

That breaking of the particles then means that they can inhale these microplastics, creating an even bigger risk for them. Where have microplastics been found? A lot of people have heard this, but they

have been found in pretty much every human organ system and biological fluid studied. That means the brain, your blood, your lungs, liver, kidneys, heart, placenta, your reproductive tissues, and your GI tract. Pretty much everywhere, they are present. I wanted to talk about what they found in placentas because I thought this study was crazy.

Microplastics have been detected in human placentas with increasing prevalence over time. In Hawaii, they actually took samples. In 2006, some of the placentas that they tested had microplastics. In 2013, 90% of the placentas had microplastics in them. In 2021, you guessed it. 100% of them had microplastics when tested. Not only did they find at that point that all the placentas had microplastics in them, but the amount of microplastics increased significantly. This is pretty concerning.

Tweet: A New England Journal of Medicine study linked the presence of microplastics in arterial plaques to a higher risk of stroke and heart attack.

Microplastics have been localized within the intracellular compartment of placental cells, and that is associated with ultrastructural alterations in mitochondria and endoplasmic reticulum. That addresses the question of whether it is doing anything. It is pretty concerning because the mitochondria are the powerhouses of the cells, and if it is affecting that, it can be significant in terms of issues.

The Cardiovascular Risks Of Arterial Plastic Accumulation

What is the data in terms of microplastics? I wanted to talk about just a couple of studies. It is really hard to tease out in these studies, separating what the effects are from microplastics and nanoplastics versus other things, and so that is something to keep in mind. A study that I thought was very good was a 2024 prospective study that was published in the New England Journal of Medicine.

This study looked at 257 patients, and they were undergoing a carotid endarterectomy. If you do not know what that is, basically it is a surgery that removes the fatty plaque or atherosclerosis that develops in your carotid arteries because that atherosclerosis can increase your stroke risk. These patients were undergoing surgery to remove that. What happened is when they removed those plaques, they went and tested them.

Patients with micro nanoplastics detected in their plaques had a four-and-a-half times higher risk of a heart attack, stroke, or death over the 34 months of follow-up compared to those who did not have detectable micro nanoplastics. This is correlation, not causation, but that is still pretty concerning. Since then, they have looked at what could be the mechanism for this. Mechanistic studies have demonstrated that micro and nanoplastics induce endothelial cell toxicity. They disrupt lipid metabolism, promote oxidative stress, facilitate foam cell formation, and activate inflammatory pathways.

All of this contributes to atherosclerosis progression. These micro and nanoplastics also affect the gut. There was a 2025 systematic review that confirmed that micro and nanoplastic exposure induces gut dysbiosis. Basically, you get a loss of your good gut bacteria and more of the bad gut bacteria growing, which then impairs your short-chain fatty acid production. This affects things like butyrate, which we went into in depth in the gut health podcast, but this is so important in terms of your gut lining for decreasing inflammation.

It has a lot of effects, and decreasing your short-chain fatty acids and your butyrate is pretty significant. All of that contributes to chronic inflammation and intestinal diseases, and it has been

linked with metabolic syndrome. That is basically an increase in waist circumference, high blood pressure, high triglycerides, insulin resistance, and type two diabetes. It is that whole category.

Consider the brain. I feel like all over Instagram, everybody talks about how you have a plastic spoon in your brain. That is how much plastic is now in your brain, a whole plastic spoon. It used to be a credit card, but unfortunately, it is true that these micro and nanoplastics cross the blood-brain barrier and do accumulate in brain tissue. Your blood-brain barrier is really supposed to be there to help filter out toxins. Unfortunately, it does not filter out the microplastics. We have seen higher accumulation in brains with documented dementia.

Again, this is correlation, not causation, but it is concerning. For your reproductive system, there was a systematic review that rated the evidence as high quality for microplastic exposure adversely impacting sperm quality, and moderate quality for effects on female follicles and reproductive hormones. For those of you who do not know, your follicles basically help with egg protection, maturation, and hormone production, so they are very important.

Those facts cover microplastics. Again, just to go over the differences, microplastics are the actual plastic particles, and the nanoplastics are the even smaller particles. Now we are getting into the endocrine disruptors. The microplastics a lot of times can be carriers of these endocrine disruptors, but the endocrine disruptors are actual chemicals. These chemicals interfere with normal hormone signaling. They can affect your metabolism, your reproduction, your growth, puberty, thyroid function, and development.

Some of them have even been concerning in terms of being carcinogenic, leading to a lot of effects. Where do you get exposed to these endocrine-disrupting chemicals? The routes are very similar to plastics. One is going to be ingestion. This main route is going to be through food and water contamination, and that is followed by inhalation of contaminated air and household dust. Dermal absorption is another route, through skin contact with personal care products and consumer goods. We are going to go into some other sources that I think people do not always think about later, but that is kind of an overview.

The Threat Of Teflon and PFAS

Chemical classes are the next topic. These endocrine-disrupting chemicals are chemicals, so there are different categories and different chemical classes. We are going to briefly go over this because I do feel like it gets overwhelming and a little bit in the weeds. There is a chemical class called PFAS. I think people have heard of that a little bit more. These are your per- and polyfluoroalkyl substances. This is a category of like 15,000 chemicals. It is a pretty big category, but areas that you would see it a lot of times are going to be in your non-stick cookware, your stain-resistant fabrics, food packaging, and a lot of water-resistant coatings, like your rain jackets and things like that.

Known effects include decreased fetal growth, dyslipidemia, and a decreased vaccine antibody response, which basically shows that it is affecting your immune system. There are also suspected links to kidney, testicular, and breast cancer. Phthalates are another group. A lot of people have also heard of these. These are dozens of structurally similar chemicals, and they are used to make plastics pliable and also as fragrance stabilizers.

When you are spraying your perfume or your cologne, spraying Febreze, washing your clothes with a detergent that has fragrance in it, or using soap or shampoo, this is something to be concerned about because a lot of times it will have this chemical class in it. These phthalates have been found to have anti-androgenic effects. That includes reduced testosterone production, decreased sperm quality, and decreased anogenital distance in male offspring. It is also linked to preterm birth and

metabolic disorders. The metabolic disruption can mean increased waist circumference, insulin resistance, type two diabetes, and high blood pressure. It is a broad category.

Tweet: Short half-life chemicals like BPA and phthalates only stay in your body for hours. Cutting them out leads to an immediate, dramatic drop.

Bisphenols are another category of endocrine-disrupting chemicals. That would include your BPA, which I think a lot of people have heard of, but also your BPS and your BPF. These are basically used in these polycarbonate plastics, these epoxy resin can liners, and your thermal receipts. When you are at the checkout, and they ask you if you want a receipt, this is where you would get that chemical on your hands, especially for the cashiers.

Known effects are on ovarian function, female reproductive toxicity, neurodevelopment, and metabolic abnormalities. One thing I did want to point out is that there are a lot of things that will say “BPA-free.” People get reassured by that, but these BPA substitutes, which are a lot of times BPS and BPF, appear similarly toxic. Just because BPA is out of your water bottle or whatever material it is, it does not mean that it is safe. These replacement particles that they are using seem to be just as dangerous.

Another category is flame retardants. That includes your PBDEs and your organophosphate esters. It is a pretty broad category, but a lot of times they are found in electronics, furniture, mattresses, and kids' products. I have a three-year-old and a one-year-old, so on a lot of the clothes that we buy, it'll say not treated with a flame retardant. When I was first learning all about this, I wondered why it would say that there. It is because some kids' clothes are actually treated with these flame retardants, which are horrible chemicals.

That is something to be aware of when you are looking for clothes and other items. It can also be in nail polish. There was a meta-analysis that showed a ten times increase in PBDE exposure during pregnancy was associated with a 3.7-point IQ decrease in the kids. Pesticides are another class, such as organophosphates and DDT. This is linked to impaired neurodevelopment, reduced sperm quality, and also suspected childhood cancers. Organotins represent another category.

Understanding The Functional Subcategory Of Obesogens

This is used in a lot of paints and PVC stabilizers. PVC pipes are used pretty much everywhere. These actually have potent obesogens that act through PPARγ activation. This list is not all of them, but these are like the big chemical classes for the endocrine-disrupting chemicals. I wanted to talk about this obesogen category. Obesogens are more of a functional subcategory of endocrine-disrupting chemicals.

It is not an actual separate chemical class like what we were just talking about, but it is more of a functional designation that basically goes across every major endocrine-disrupting chemical category. These obesogens are endocrine-disrupting chemicals, but they promote obesity by altering lipid homeostasis, increasing adipogenesis, which basically means increasing the creation of fat cells, disrupting metabolic set points, and modifying appetite regulation. The chemicals that have the most consistent human epidemiological evidence for obesogenic effects are BPA, DDE, and PFOA.

I like to know how, and this is not all of the mechanisms, but these are some of the major mechanisms. One is through PPARγ activation. PPARγ is like the master regulator of adipogenesis. Basically, it is helping regulate when your body makes new fat cells. This will then increase your adipocyte number, meaning the actual number of fat cells, but it also will increase the size. It will recruit new fat cells, and it will enlarge existing ones.

The other way these obesogens can work is that they alter hormonal regulation of appetite and satiety. Instead of you feeling full when you are supposed to feel full, you are still feeling hungry. It can also affect food preferences through effects on hypothalamic signaling. Another way that this can affect weight gain and obesity is through the gut. It disrupts the ecology and function of the gut microbiome. It then promotes this inflammatory pathway and alters the metabolic pathways that all contribute to obesity.

There was a systematic review and meta-analysis of 73 studies. This had over 100,000 individuals that it looked at, and it found that BPA exposure was significantly associated with being overweight, being obese, or having an increased waist circumference in adults. Another thing to be aware of is the epigenetic and transgenerational effects of these obesogens. One of the most striking aspects of obesogen biology is the capacity for transgenerational inheritance.

The in utero and neonatal periods are the most sensitive window for these obesogen actions. The American Academy of Pediatrics clinical practice guidelines on childhood obesity actually acknowledge that prenatal exposure to EDCs, such as endocrine disruptors like BPA and PFAS, is associated with childhood obesity. Postnatal exposure through household products, food packaging, breastfeeding, formula, and baby products can affect endocrine and metabolic programming. Trying to limit exposure here is so important.

I wanted to get into Teflon. People are more aware of the dangers of Teflon now, but there are two categories and different ways that they are dangerous. I wanted to touch on it a little bit. One is from the actual PFAS chemicals. The PFAS chemicals used in the manufacturing are actually classified as a group one carcinogen. This is very concerning in terms of the cancer effects. There are also thermal decomposition products that can be released when they are overheated, and that can cause a separate thing called polymer fume fever and acute lung injury.

Tweet: Kids face the highest risk of chemical exposure on artificial turf fields due to their hand-to-mouth habits and faster respiratory rates.

The Trap Of BPA-Free Alternatives

Teflon is a brand name for polytetrafluoroethylene, or PTFE. This is basically a fluoropolymer coating applied to cookware to create non-stick surfaces. PFOA was historically used as a processing aid in PTFE manufacturing. A lot of you know that this has started to be phased out. It has been largely phased out of production, and it is replaced by other chemicals like GenX. This is something that I do want to point out and stress. These replacement chemicals are suspected to have similar toxicity.

If you are buying non-stick cookware, this is really concerning because they could have the exact same issues that Teflon has, similar to what we talked about for BPA. These replacement materials that they use instead are concerning because they are going to have the same effects. That is how this replacement for Teflon is. When you are buying your non-stick products, it is very concerning that it has the same effects as Teflon does.

These are all in the broader PFAS forever chemicals family. In 2023, these were linked as a group one carcinogen. That means there is sufficient evidence for carcinogenicity in humans, meaning it is cancer-causing. It is specifically linked to kidney and testicular cancer, along with all the other effects. It is linked with dyslipidemia, thyroid dysfunction, decreased fetal and infant growth, liver enzyme elevation, ulcerative colitis, and metabolic disruption.

You are thinking of insulin resistance, diabetes, hypertension, and hypertriglyceridemia. There is this other issue, which is when you are cooking with this. You can get this PTFE-coated cookware releasing chemicals basically in a temperature-dependent manner, which makes sense. The hotter it

gets, the more chemicals it is going to release. At a normal temperature, it is less, but if you are overheating it, especially when you get around 500 degrees Fahrenheit, there is a 2,500 times increase in these chemicals that are released.

Extreme overheating, where you are getting to 572 degrees Fahrenheit, causes it to undergo pyrolysis. This creates super fine, really tiny particles and a toxic fluorinated gas. This is actually called polymer fume fever and acute lung injury because that is what it can cause. Polymer fume fever is basically a well-characterized clinical syndrome that is caused by inhalation of those breakdown products, so you get flu-like symptoms. This includes fever, chills, muscle aches, and headaches.

Usually it starts 4 to 10 hours after the exposure. These ultrafine particles trigger a massive pro-inflammatory cytokine release, oxidative stress, and neutrophilic inflammation in the lungs. In terms of severity, it can be wide. It can be where you recover after you get that flu-like illness, but it can be so severe that it is fatal. There are cases where people have had fatal hemorrhagic pulmonary edema. It is very concerning, and I would highly recommend no Teflon and trying to get rid of non-stick as much as you can.

The next category I wanted to talk about was turf. Turf has skyrocketed in popularity. I feel like almost every school is replacing fields, and playgrounds have them. I feel like people are putting them in their backyard, and I think people have not quite made the connection in terms of not just the microplastic exposure, which we talked briefly about earlier, but also all of the endocrine-disrupting chemicals and all of the chemical exposure. Let us get into artificial turf.

One of the biggest health concerns with it is actually the crumb rubber. This is made from recycled end-of-life tires, and that is used as a cushioning infill for most of the synthetic turf fields. There was a global analysis of 91 crumb rubber samples from seventeen countries that spanned four continents, and they identified all 42 target hazardous chemicals. That is wild. That is how many bad chemicals they found. Some of them were polycyclic aromatic hydrocarbons, or PAHs. Those are classified as carcinogens, like cancer-causing agents. Again, this turf is in people's backyards, kids are playing on it, and it is in schools. It is just wild to me.

The study also found benzo[a]pyrene, which is also a group one carcinogen. A bioaccessibility study looked at contact with crumb rubber and subsequent detection, and it found that benzo [a] pyrene was detected in 75% of samples. Another thing that is in turf can be heavy metals. A study of dust from synthetic turf fields in Beijing found that heavy metal levels were significantly above background values, with health risks estimated to be three to five times higher for kids than adults.

Endocrine disruptors like BPA, phthalates, and DEHP were detected migrating from the rubber granules into artificial sweat and saliva. These are again known endocrine disruptors with obesogenic and reproductive toxicity potential, like we just talked about. The New England Journal of Medicine, which I am actually going to link in the show notes, has a really good table that goes through a lot of the different endocrine-disrupting chemicals and other chemicals, noting where the exposure can be and some of the concerns in terms of risk.

The New England Journal of Medicine review on fossil fuel-derived endocrine disruptors specifically identifies artificial turf as a source of PFAS, flame retardants, and phthalates. What's important here is that kids are at the highest risk because you just think about a toddler who is touching the ground and then touching their mouth, and babies. Kids in general are putting everything in their eyes and their mouth, so this whole hand-to-mouth behavior creates a higher risk. They also just have greater skin-to-surface contact.

You just think they are running around and sliding. They are going to be the kids that are rolling around in what is not grass anymore. It is artificial turf. They are getting all these chemicals and the microplastics. They have way more exposure that way. They are running around, so they are

breathing heavier. That respiratory rate is increasing, so they are breathing in these particles more. They are in an increased vulnerable time in terms of their growth. A lot of these kids have not gone through puberty yet, and these endocrine disruptors can have significant effects on that. They can have effects on their growth, on their weight, and on so many things.

It is really something that people need to be more aware of. When you are looking at risk, older fields will have a higher risk because they are going to have more of this breakdown. Older fields will release more of these particles than the newer ones, which makes sense. Hot weather also increases risk. I live in Florida, and that heat is something that people also do not consider. With this heat, you are going to have increased breakdown. You are going to have increased breakdown of not only the microplastics, but you are also going to have an increased release of these endocrine-disrupting chemicals.

It is huge. In Florida, where people are replacing grass left and right with this turf, we have an increased risk. I also think in places like California and a lot of desert areas where it gets really hot, the same issue applies. This is something for people to be aware of. It can get a little overwhelming, but I want people to be aware of this because when people do not know this, they are more likely to turf their backyard if they are thinking about it and are not aware of the risks.

If they are going to a school board meeting and the school is talking about replacing the playground with turf because then the kids are less messy, this is something where people can advocate and say, "I do not want my kids exposed to this, and we should not be doing this." The same applies to cities. The more people are aware of this, the fewer playgrounds are putting in turf and the less exposure our kids get to this.

This is so important for people to be aware of. If you are in a place where you are fighting against turf and, for whatever reason, no one is listening, and they are set on placing turf, see if you can at least get the cork rubber infill. That is, instead of using this crumb rubber from the old recycled tires, you are using cork. That would at least decrease a lot of the chemicals, which is also something to be aware of.

In terms of precautions, we cannot live under a rock. Our kids are going to go out and play, you are going to go out and play, and there is going to be turf. Washing hands is something big. Also, wash exposed skin after playing. Try to avoid eating on the field because then you are just increasing all of the exposure in terms of ingestion as well, not just the inhalation. If you can shower afterwards, I think that is also good, too. Being aware is key. If there is a playground that has turf, and maybe you cannot always avoid it because your kids still want to go there or you are going to have playdates, try to limit it when it is really hot out. Things like that can at least decrease exposure.

Other surprising places in terms of exposure to microplastics and endocrine-disrupting chemicals are things I just wanted to briefly talk about because I think people do not always think of them. One of them is in coffee cups. If you go to Starbucks or one of your other coffee shops and you get a to-go cup, a lot of people think this is a paper cup and it is fine. If you feel that inside, it usually has this plastic lining in it. You are then having somebody pour hot coffee into it, which then will release all of the microplastics and whatever endocrine-disrupting chemicals those have on them.

That is one area that a lot of people do not think of. Also, all cans have this lining in them. A Coke can, a seltzer can, or whatever can has this plastic lining in it. That is another area that people do not think of, along with other canned goods, too, like your canned beans or any of your canned products. We talked already about receipts, but that is another big one for people to be aware of. It is easy to just say you do not need that receipt or ask them to email the receipt, which is usually an option now.

Another big one, especially for the endocrine-disrupting chemicals, is fragrances. We talked about it a little bit before, but your perfumes, your Febreze, the fragrances that can be in the shampoo and conditioner, and the fragrances that can be in so many things require you to look out for them. If you are doing your laundry, look at your laundry detergent. You really want fragrance-free so it does not have all of these chemicals in it.

Hearing about all the exposure can be a little overwhelming, and people wonder what they can do since it is everywhere. They ask if it is really going to make a difference and why they are even learning about this. There actually is something that you can do. The biggest thing is reducing exposure. This is the most effective and well-studied way to decrease your risk. That is by far number one. For certain other chemicals, enhancing your natural elimination pathways can help.

I wanted to get into these different categories of endocrine disruptors because you have what we call short half-life endocrine disruptors. This would be more of your BPA, your phthalates, and your parabens. These only stay in your system for hours to days. Exposure reduction alone leads to a rapid decline. It is actually very encouraging because when you cut those out, you actually see a huge change in terms of the amount that is in your body. It is encouraging for those chemicals.

There are other chemicals which have a long half-life, and these are a lot of times referred to as forever chemicals. This would be your PFAS. Again, non-stick cookware is in that category. This is another reason to try to get rid of it because once it is in your body, it really hangs around for a really long time, much like a lot of your pesticides and your PCBs. These can stay there for years to decades.

Tweet: You don't need to replace everything at once. Start by removing plastics that come into direct contact with heat, acid, or mechanical stress.

Your short-half-life endocrine disruptors, again like your BPA, your phthalates, or parabens, are metabolized and excreted within hours or a day. I find this really encouraging, that decreasing your exposure leads to measurable declines in your body pretty much right away. I wanted to talk about a pretty new study. There was this Perth trial in 2026. This was a randomized controlled trial of 60 participants. This looked at a seven-day low-plastic dietary intervention, and with that, it reduced urinary levels of monobenzyl phthalate by 53% and BPA by 59%.

This intervention basically provided foods that minimized all plastic touchpoints from production to plate, along with plastic-free kitchenware. Limiting, especially what you are ingesting, is key, especially since we talked about before and will talk about at the end. Things that you are going to be eating, especially with heat, because it is going to increase the degradation, meaning the breakdown of those products. That is the number one spot to start if you have to start somewhere.

You have these long half-life persistent chemicals. These are like your PFAS. These are a lot harder to eliminate. A meta-analysis estimates that the serum half-life ranges from one to all the way up to nine years depending on the substance. Part of this is because they actually have this enterohepatic recirculation. They are excreted in the bile, but then your intestines reabsorb the bile.

This is a normal process, but when they latch onto this bile, it just goes around in this circle, like a feedback loop. I did want to talk about possible future approaches because there have been some encouraging studies in terms of decreasing the amount that is in people's bodies. One of them was cholestyramine. This is a bile acid sequestrant, and this medicine has actually been around for decades. Two studies supported that taking these bile acid sequestrants would decrease the levels.

There was a Swedish crossover trial for highly exposed individuals, and it found that twelve weeks of a bile acid sequestrant reduced serum PFAS by 38%. They had a control group, and that was only a

decrease of two percent. A 38% reduction compared to 2% represents a big difference. There was another study that I thought was really cool, and it actually looked at firefighters.

For those that use cholestyramine, it actually decreased the half-life. They found that it was only in their system for 1.2 years in comparison to 7.3 years for the untreated individuals, which is a huge change. I actually really liked that study because they had your observation group, meaning the group where they did not do any interventions, and then they had the group that they gave the cholestyramine to, which was the bile acid sequestrant.

They also had a group that did plasmapheresis, and then they had a group that did both. The plasmapheresis also showed positive results in terms of decreasing the levels, and the group that did both had an even bigger effect. Plasmapheresis, which we will talk about next, and phlebotomy are more invasive. For the average individual, I feel like it is not something that most people can do, but the bile acid sequestrant is available and has been out for a long time.

For individuals who have a higher risk in terms of exposure, like firefighters, there is a lot of risk in terms of people's jobs where, unfortunately, it is just hard for them to cut out the exposure. This is very promising to touch base real quick on plasmapheresis and phlebotomy. There was a case series of six highly exposed family members who were treated with intermittent phlebotomy over four to five years, and they had significantly accelerated PFAA clearance compared to untreated reference populations.

Again, that firefighter study where they did plasmapheresis showed a significant decrease. With this class, unfortunately, sweating does not help much, so this is not where a sauna helps. I do think fiber is something to be talked about as well. Evidence suggests that higher dietary fiber intake is associated with lower serum PFAS concentrations. The issue is that the data is primarily cross-sectional. There was only one small interventional study that directly tested fiber as a PFAS reduction strategy.

This was a Canadian clinical trial that was actually originally testing dietary fiber for cholesterol reduction, so it was not even supposed to be looking at this. That is really the only interventional data that we have in terms of fiber and decreasing these PFAS. In this study, there were 72 adult males with elevated cholesterol, and for four weeks they did a dietary fiber supplement, and that showed a decrease in the long-chain PFAS.

The hypothesis for this is that fiber basically works similarly to how a bile acid sequestrant would work because fiber helps bind the bile acids and then you excrete them. If it is binding these bile acids where these chemicals are latched onto instead of the intestines, then reabsorbing them, you are pooping them out. That should be decreasing the levels. Dietary fiber, especially soluble fiber, binds bile acids in the gut lumen, reducing reabsorption.

The issues with this are that pretty much all the human data is cross-sectional. That is very difficult in terms of establishing causation. Higher fiber intake could simply be a marker of healthier diets, and then they happen to have lower PFAS exposure because of their food sources and have less exposure overall. The other issue with this is it was a very small interventional study of just 72 patients, and it was short, lasting for just four weeks. I think the biggest thing is it was not actually meant to study PFAS. This was just another finding that they found.

The other part is that the effect is a lot smaller than what the cholestyramine bile acid sequestrants achieve. This showed really only a 3 to 9% reduction versus cholestyramine, which was closer to 38%, so that is a lot higher. Again, we do not really have enough studies. I would love to see a study that compared fiber to cholestyramine specifically looking at this. Fiber is so good for you for so many other reasons in terms of your risk. It is not taking another medication.

It is increasing something that is so healthy for your body. It decreases your colon cancer risk, helps with your gut lining, decreases inflammation, and increases the short-chain fatty acids like butyrate that are so important for your body. There are just so many health benefits to fiber. If this is another one to add to that for why we should be increasing our fiber, I think that people should be aware, and it is also encouraging because that is something that people can do. You can add more fiber.

How do we get rid of microplastics? Unfortunately, there is no established method to remove microplastics that are already in human tissues. To date, what is in your brain, in your liver, and in all your tissues, unfortunately, is there now in terms of what you are exposed to. We did talk about the increased exposure. There is fecal excretion because ingestion is one of the biggest sources for microplastic exposure. Excreting it from what you were exposed to is part of it, and then also you have this mucociliary clearance.

That is basically the system where you have these features that look like fingers in your lungs that help move things out. That helps for inhaled particles in the respiratory tract, and then you have biliary excretion for particles that translocate to the liver. Something that I find interesting, and I am really hoping that they do human studies on this, is emerging evidence that some probiotic strains can decrease microplastic absorption. There are specific probiotic strains like Lactobacillus paracasei Lpc-37 and Lactoplantibacillus plantarum DT88.

This showed increased fecal microplastic excretion by 34% and reduced intestinal polystyrene particles by 67%, but it was in a mouse model, so we do not have human data. I do think it is encouraging. In terms of fiber, emerging preclinical evidence strongly supports that dietary fiber can physically absorb microplastics in the intestinal lumen, reduce intestinal microplastic burden, and attenuate associated inflammation. Again, we have no human trials, but I do think that there was one of the strongest studies to date investigating wheat bran insoluble fiber as an edible absorbent for microplastics.

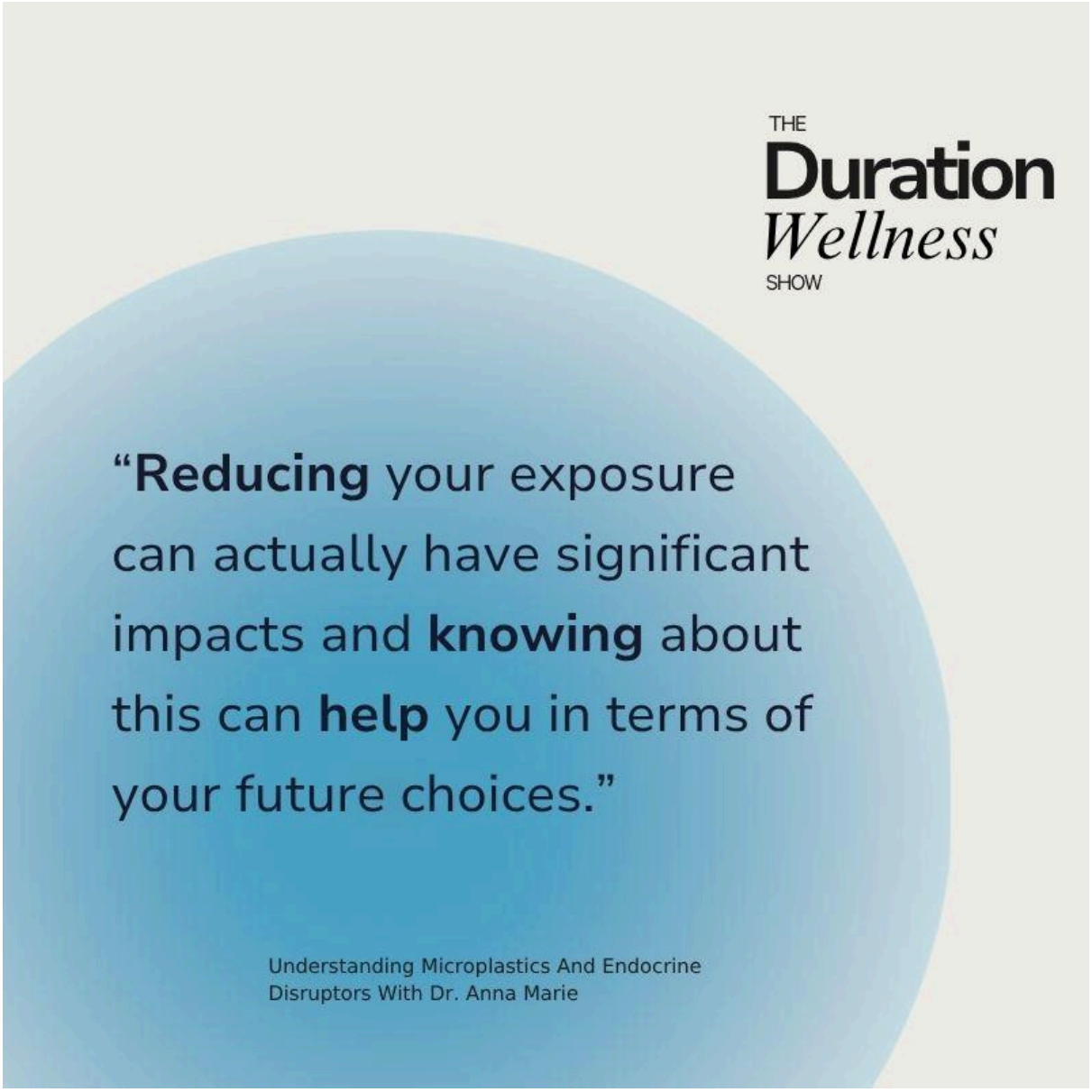
In simulated intestinal fluid, this absorbed microplastics. You can think about it as a gel-like substance, which is what fiber ends up becoming in the gut, and so that would trap these microplastics inside it. It is almost like a gel that would be sticky to the microplastics, meaning your body is not absorbing them. Fiber provides another reason to add it. In terms of the benefits of fiber, there are so many, and if it also helps possibly decrease your microplastic absorption, that is another win.

For microplastics, unfortunately, there is no data that you can sweat these out, so a sauna is just not one of the things that helps. For all the other persistent organic pollutants, such as heavy metals, organochlorines, and PBDEs, lipophilic persistent pollutants are where sweating actually shows benefit. There was a study that found that 80% to 100% of participants excreted PBDE flame retardants in perspiration. That was encouraging in terms of being able to sweat some of those out.

Also for dynamic exercise, there was an even higher concentration of heavy metals that were excreted compared to passive sauna sweating. Both would excrete them, but if you are exercising, especially dynamic exercise with a lot of sweat, that excretes even more heavy metals, which is encouraging, too.

Practical Strategies For Eliminating Toxins Daily

To wrap up, I think it can be a little overwhelming to hear of all the sources that we are exposed to, but I think reducing exposure really is one of the biggest ways you can make an effect, and knowing about this is the first step to being able to reduce your exposure. Ingestion again is one of the biggest categories. If you can ditch the plastic, that is huge because not only are you getting the microplastic exposure, but these plastics are also carrying a lot of these endocrine-disrupting chemicals in them.



If you are limiting what you are exposing yourself to, that is major. I do understand everybody has different budgets, so not everybody can go and buy a whole new set of everything. Where a lot of people can start is with things that are really in contact with heat the most. Really try not to use plastic spatulas. Try to use more of your stainless steel, and limit the use of non-stick cookware for things that are heated up, as it is going to leach more of this.

You are going to get more of the chemical breakdown and the actual plastic particle breakdown. The next step I would probably go to is things that are getting cut up, involving any of that mechanical stress. If you think about using a plastic cutting board or a plastic knife, all of that can break down those particles more. Consider acid. When you are buying things in containers, thinking about how much acid is in there is important because that will increase the leaching, too.

I would go through it in that order and start with the biggest things, especially if you have kids. When you are looking at baby bottles to buy, try to get the glass and not the plastic. Things like that can

really make a big difference. A water filtration system is great. I know everybody cannot go out and install a reverse osmosis system, but even if you are cutting down and stopping all of the plastic water bottles that you are using, it helps.

We talked about how much microplastics are being released, and those plastic particles are then carrying a lot of these endocrine-disrupting chemicals on them. If you can switch out to a stainless steel water bottle and use that, it can have huge effects. A good air filtration system is also beneficial. These used to be so expensive and really difficult for people to get in their house, but now they make so many in so many sizes and at so many price points. This really does help reduce both microplastic and endocrine-disrupting chemical exposure.

You might not be able to go and replace everything right now, but things are going to break, and you are going to need to replace items. Now that you are more aware of this, hopefully this can also affect your future choices. When your pot breaks and you need to get a new pan and pot, now you are going to buy the stainless steel. When your shirt has a hole in it and you need to go buy a new shirt now, you are going to get the cotton or the linen. It can affect your future consumer choices and have a big impact there. If you are having kids, it can affect what you put on your registry, or if you are having a new grandkid and your daughter or son is making a list, this is where you can help educate them so that when they make their lists, they are getting the glass products.

They are not getting the flame-retardant-sprayed clothing for their kids. It really can make a big difference. Overall, I know this can be overwhelming, but I want people to take this as a message of hope that reducing your exposure can actually have significant impacts and that knowing about this can help you in terms of your future choices. I hope this was educational and helped some of you out there. Thanks for joining us on another episode, and see you again soon. Bye.

Important Links

- Dr. Anna Marie McCarthy on Instagram
- Duration Wellness on Instagram
- Duration Wellness

About Dr. Anna Marie

Dr. Anna Marie, MD, MPH, has a passion for preventive medicine and public health. With a strong foundation in both clinical care and population health, she brings a holistic perspective to wellness—focusing not just on treating illness, but on empowering individuals and communities to stay healthy in the first place.

Dr. Anna Marie combines medical expertise with a deep commitment to education, helping audiences better understand how everyday choices impact long-term health. Whether discussing lifestyle, chronic disease prevention, or health equity, she is dedicated to making medical knowledge accessible, practical, and actionable.

Through her work, Dr. Anna Marie inspires a proactive approach to health—where prevention, awareness, and informed decision-making take center stage.

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Summary

Prospective observational study of patients undergoing carotid endarterectomy for asymptomatic carotid stenosis found detectable microplastics/nanoplastics in 58.4% of plaques, mainly polyethylene, and their presence was associated with a higher rate of myocardial infarction, stroke, or death during about 34 months of follow-up. Because the study was nonrandomized, included a selected surgical population, and could not fully exclude contamination or unmeasured confounding, it shows an association rather than proving that plastics caused events.

N: N=257 (exposed: 150; unexposed: 107)

Design Subtype: Prospective, multicenter, observational study

Follow-up: Mean 33.7±6.9 months

Adjustment Method: Multivariable adjusted Cox regression

Population: Patients with asymptomatic high-grade carotid stenosis

undergoing endarterectomy
Exposure: MNPs detected in carotid plaque
Comparator: No MNPs detected in plaque
Outcome: Composite nonfatal MI, nonfatal stroke, or all-cause death
Effect Measure: aHR 4.53 (95% CI 2.00–10.27)
Research in Context
• Emerging evidence: first prospective human observational link between MNPs in atherosclerotic plaques and adverse cardiovascular outcomes; prior evidence largely preclinical
• Subsequent work: 2025–2026 reviews and mechanistic studies implicating oxidative stress, inflammation, endothelial dysfunction, and foam cell formation; 2025 mouse study demonstrating sex-specific atherogenic effects
• Evidence gaps/contested elements: Nature Reviews Cardiology (2026) notes causality unproven in humans, major methodological challenges, limited epidemiology, and lack of replication in human cohorts

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Table 1. Examples of Fossil Fuel–Derived Chemicals with Known, Likely, or Suspected Endocrine Effects.*

Chemical Class and Examples	Major Exposure Sources	Health Effects		Specific Effects
		Known or Likely	Suspected	
PFASs: PFOA, PFOS, PFHxS, PFBS, PFBA†	Consumer products (e.g., nonstick cookware, stain-resistant clothing), building materials (e.g., stain-resistant carpeting), personal care products (e.g., cosmetics, menstrual products), food packaging materials, drinking water, industrial facility releases, legacy environmental exposures	Decreased infant and fetal growth, dyslipidemia, decreased antibody response to vaccines in children and adults[9]	Kidney cancer, testicular and breast cancer, gestational hypertension and preeclampsia, thyroid disease and dysfunction[9]	A meta-analysis of 24 studies showed a 10.5-g decrement in birth weight per 1-ng increase in PFOA/ml, and an analysis of 29 studies showed a 3-g decrement in birth weight per 1 ng PFOS/ml increase.[45] EPA's proposed new standard to reduce drinking water levels of PFOA and PFOS to 4.0 ppt is projected to result in savings of $175 million annually because of increased birth weight and reduced deaths attributed to low birth weight.
Ortho-phthalates: DEHP, DBP, BBP, DEP, DINP	Food, personal care products (e.g., fragrances), food packaging materials, building materials (e.g., PVC flooring), industrial facility releases	Male reproductive toxicity (e.g., sperm effects), decreased anogenital distance,[30,44] preterm birth,[44] metabolic disorders (e.g., insulin resistance, diabetes)[44]	Spontaneous abortion,[44] neurodevelopmental harms (e.g., ADHD)[46]	A meta-analysis of 5 studies showed that a log increase in gestational DEHP levels was associated with a 4% reduction in anogenital distance in human male offspring, reflecting reduced fetal testosterone production.[30]
Flame retardants: PBDEs, organophosphate ester flame retardants (OPFRs)	Consumer products (e.g., electronics, furniture, mattresses, children's products), personal care products (e.g., nail polish), plastics, industrial facility releases, legacy environmental exposures	Impaired neurodevelopment[47]	Altered thyroid function in newborns,[33] reproductive toxicity[4,23]	A meta-analysis of 4 U.S. and European studies showed that an increase by a factor of 10 in PBDE exposure during pregnancy was associated with a decrement of 3.7 IQ points in the offspring.[47]
Bisphenols: BPA, BPS	Polycarbonate plastic products (e.g., water bottles, food-storage containers and packaging, eyeglasses), epoxy resin liners of aluminum cans, and other consumer goods such as thermal paper receipts[36]	Adverse effects on ovarian development and function,[48] female reproductive toxicity, impaired neurodevelopment, metabolic abnormalities, immune system abnormalities[10]		A study of 700 couples from China showed that an increase of 1 ln unit in urinary concentrations of BPA in women was associated with a longer time to pregnancy (OR, 0.87; 95% CI, 0.78–0.98) and an increased risk of infertility (OR, 1.23; 95% CI, 1.00–1.50).[49]‡
Heavy metals: lead, cadmium, mercury, arsenic[2]	Consumer products (e.g., dishware, ceramics, jewelry, children's products), spices, personal care products (e.g., skin lighteners), tobacco smoke, industrial facility releases, legacy environmental exposures	Impaired neurodevelopment, male reproductive toxicity (e.g., impaired semen quality, fertility effects), female reproductive toxic effects, cancer, immunosuppression[36,50]		A pooled analysis with a total of 1333 children from 7 longitudinal cohort studies showed a 6.9-point reduction in IQ with an increase in blood lead levels by a factor of approximately 10.[51]
Pesticides: organophosphate pesticides, neonicotinoids, pyrethroids, DDT[2]	Food and drinking water, insecticides, rodenticides, herbicides, spray drift from use in agricultural fields	Impaired neurodevelopment (e.g., lowered IQ),[36] reduced sperm quality[52]	Increased susceptibility to childhood cancers (e.g., leukemia and brain tumors), increased susceptibility to testicular cancer, impaired fetal growth[3,4,23]	A birth cohort study of 329 children showed an average 7-point IQ deficit for children in the highest quintile of exposure to organophosphate pesticides during pregnancy, as compared with those in the lowest quintile of exposure.[53]
Volatile organic compounds: benzene, formaldehyde, toluene	Consumer products (furniture, textiles, glues, paints, detergents, disinfectants), personal care products (cosmetics, fragrances, nail polish), tobacco smoke, gas-stove emissions, fireplace emissions, industrial facility releases	Respiratory toxicity, lung cancer, nasopharyngeal cancer, leukemia, acute neurologic harm (e.g., dizziness, vomiting), female reproductive toxicity (e.g., increased time to pregnancy, spontaneous abortion risk), altered male reproductive system, reduced fetal growth[3,4,23,54]		A meta-analysis of 15 studies showed an elevated risk of leukemia (RR, 1.54; 95% CI, 1.18–2.00) among workers exposed to high levels of formaldehyde.[55]

* The health effects are based on authoritative reviews from the United States and globally.[3-8,23] Known or likely health effects are those for which associations with a given class of endocrine-disrupting chemicals (EDCs) or EDCs in that class have been classified in a robust or systematic review as known, causal, sufficient, presumed, likely, robust, or moderate. Suspected health effects are those supported by a lower level of evidence. The list of reported health effects is not comprehensive. ADHD denotes attention deficit–hyperactivity disorder, BBP benzyl butyl phthalate, BPA bisphenol A, BPS bisphenol S, DBP dibutyl phthalate, DDT dichlorodiphenyltrichloroethane, DEHP di(2-ethylhexyl)phthalate, DEP diethyl phthalate, DINP diisononyl phthalate, EPA Environmental Protection Agency, IQ intelligence quotient, ln natural logarithm, OPFR organophosphate ester flame retardant, OR odds ratio, PBDE polybrominated diphenyl ether, PFAS perfluoroalkyl and polyfluoroalkyl substances, PFBA perfluorobutanoic acid, PFBS perfluorobutanesulfonic acid, PFHxS perfluorohexane sulfonate, PFOA perfluorooctanoic acid, PFOS perfluorooctane sulfonate, RR relative risk, and PVC polyvinyl chloride.

† Some chemicals in this class are also persistent pollutants that, owing to their physical structure, persist and bioaccumulate in the environment, thus leading to biomagnification up the food chain and ongoing and widespread exposures through multiple sources, including dust and food.[3]

‡ Data supporting the reproductive toxicity of BPA, which has been classified as "known" or "likely," are based primarily on robust animal models.[10,36]

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