

Tiny Particles, Big Problems: Microplastics in Our Drinking Water

Fossil fuel-backed plastic production continues to pollute our environment and our drinking water with tiny plastic particles. New research confirms the pervasiveness of micro- and nanoplastics in our environment, water, and bodies. Emerging studies discuss holistic impacts across the human body, explore neonatal exposure, and identify microplastics as another source of toxic PFAS exposure. It is time for the U.S. Environmental Protection Agency (EPA) to mandate that public water systems test our drinking water for these plastic contaminants, so we can better understand the threat and make strides toward protecting public health.

What Are Micro- and Nanoplastics?

Microplastics are plastic fragments or particles less than 5 millimeters in diameter.¹ Nanoplastics are even tinier at less than 1,000 nanometers² (around 100 times smaller than the width of a human hair).³ Primary micro- or nanoplastics are intentionally produced and added to products, such as microbeads in body scrubs, or are used in fields of medicine, such as nanosensors and imaging. Secondary micro- and nanoplastics form when plastic waste degrades.⁴ Two main sources include tire wear and the laundering of synthetic fibers.⁵ Secondary forms can also originate from plastic or plastic-coated cookware found in your home.⁶

Micro- and nanoplastics are carriers for pollutants and toxins because of their size, abundance, and ability to stick to biological components,⁷ and they are easily ingested or inhaled by all kinds of life.⁸ Scientists estimate that we ingest around a credit card's worth of microplastic every week.⁹ A recent study looking at human brain samples found that concentrations of micro- and nanoplastics are increasing dramatically, and suggested that we may currently have a plastic spoon's worth of plastic accumulated in our brains.¹⁰ Additionally, nanoplastics in particular may penetrate the skin,¹¹ a concern given that some cosmetic products are composed nearly entirely of plastic. Daily use of cosmetics generated 3,800 tons of microplastics in continental Europe in 2023.¹²

Microplastics Can Be Mega-Harmful

Thousands of toxic chemicals are added to plastics, and they can be released when the plastic degrades. Some of these chemicals have the potential to bioaccumulate, or to concentrate in the body over time.¹³ Micro- and nanoplastics may be coated in toxic chemicals and can even adsorb additional toxins, effectively doubling-down on inherent harmful effects.¹⁴ These include phthalates and bisphenol A (BPA), polychlorinated biphenyls (PCBs), heavy metals, flame retardants,¹⁵ pesticides, and antibiotics.¹⁶ Microplastics are also efficient carriers of compounds such as per- and polyfluoroalkyl substances (PFAS)¹⁷ (also called "forever chemicals"), which have their own concerning links to health effects including decreased

birth weight and cancer.¹⁸ In addition, microplastics can interact with microbes and alter or enhance the toxicity of chemical additives.¹⁹

Research has further confirmed that microplastics are able to adsorb PFAS, increase PFAS concentration over time, and increase PFAS resistance to environmental degradation. Emerging research suggests that combined exposure to PFAS and microplastics can have greater health effects than if exposed to either alone.²⁰ Microplastics have now become a second source of PFAS, allowing them to continually diffuse across the environment.²¹

Once ingested, microplastics can accumulate in cells, tissues, and organs, causing damage to cell walls and leading to early cell death.²² Exposure to micro- or nanoplastics is linked to microbial imbalances in the gut, intestinal inflammation, and increased gut permeability known as “leaky gut.”²³ More research is highlighting the interplay between the gut and other body systems, effectively linking microplastic-induced harm in the digestive system with liver, kidney, cardiovascular, and neurological damage.²⁴ Aside from inducing abnormal heart rates²⁵ and an increased risk of heart attacks and strokes,²⁶ microplastics have been shown to penetrate and damage lung tissue.²⁷

Recent studies suggest that microplastics may cross the blood-brain barrier and contribute to cognitive impairments.²⁸ One pioneering study found that micro- and nanoplastic levels in the brain were 7 to 30 times higher than in the liver and kidneys, with even higher concentrations observed in brains with dementia.²⁹ The harmful effects of these plastics go beyond the brain, causing oxidative stress and inflammation that plays a role in cancer development across the body.³⁰ Microplastics can also cause reproductive harm in both males and females.³¹

Sensitive groups such as infants and children are often more exposed and more at risk for developing health effects from micro- and nanoplastics.³² Recent studies documented microplastics crossing the placental barrier, where they could accumulate in tissues and impact fetal development.³³ Animal and human studies have documented the negative systemic effects of prenatal microplastic exposure in offspring and children.³⁴ Studies have linked higher concentrations of microplastics in younger children with hay fever³⁵ and with impacted memory and increased inattentiveness.³⁶

Although exact levels of microplastics observed in our bodies, their sources, and their harms are still being studied,³⁷ there is already extensive evidence and documentation of how microplastics are widespread in the human body.³⁸

Microplastics Are Everywhere, Including in Our Drinking Water

Globally, we produced 400 million metric tons of plastic in 2022, and research estimates that plastic production has doubled in the past two decades and could triple by 2060.³⁹ Three hundred million tons of this waste reaches our oceans.⁴⁰ There, it breaks down and transforms from exposure to ultraviolet radiation, waves, and microorganisms.⁴¹ Microplastics harm marine life since they adsorb toxic pollutants and resemble food.⁴² Microplastics have been documented across the planet’s oceans and seas, as well as in freshwater, rainwater, and drinking water sources.⁴³

Drinking water is one of the main, and most alarming, ways that people can ingest microplastics.⁴⁴ Studies have confirmed that microplastics occur in tap water worldwide, including in the U.S.⁴⁵ One study estimated that consuming only tap water adds around 4,000 microplastic particles annually into our bodies,⁴⁶ and the researchers believe this is an underestimate.⁴⁷ Another study took 159 water samples across the globe in

2017 — including 33 tap water samples from major U.S. cities such as Buffalo, Chicago, Los Angeles, New York City, and Washington, D.C. — and found that the U.S. had the highest concentration of microplastics in its tap water.⁴⁸

A second tap water study found that the highest microplastics concentrations observed in U.S. samples exceeded the levels present in 32 out of 37 samples taken in the European Union and Japan.⁴⁹ A pioneering 2025 study of several rural communities in the U.S. Appalachian region found tap water samples contaminated with microplastics at average concentrations ranging from 5.5 to 20 particles per liter and co-occurring with heavy metals and PFAS; the sites in Kentucky had more than double the mean concentration for U.S. samples established in the 2017 study.⁵⁰ U.S. drinking water treatment plants are currently unable to remove 100 percent of microplastics.⁵¹

Bottled water is not a safer alternative since most bottled water contains tap water, and single-use plastic bottles can increase the amount of microplastics you can ingest by around 680⁵² to 700 percent.⁵³ The plastic that is used to manufacture single-use bottles, caps, and their packaging is what creates widespread microplastic contamination in bottled water.⁵⁴ One recent study estimated that every liter of bottled water contains an average of 240,000 micro- and nanoplastics, 90 percent of which are nanoplastics.⁵⁵ In fact, research suggests that bottled water could be one of the main ways we ingest microplastics.⁵⁶

When It Comes to Microplastics, What We See Is Not All We Know

Current understanding of the ubiquitous nature of micro- and nanoplastics and their harmful effects is likely the tip of the iceberg. Their size in addition to the lack of defined analytical techniques or databases that would help shed light on their physiochemistry and varied plastic compositions creates a diverse problem that is difficult to comprehend.⁵⁷ This is largely because the U.S., among other governments, lacks proper studies, initiative, and regulation aimed at understanding the full enormity of the issue.⁵⁸

While there is need for improvement,⁵⁹ various detection and analytical methods are available to begin identifying and characterizing micro- and nanoplastic particles in water.⁶⁰ What is missing is a regulatory move from the EPA to start monitoring microplastics in drinking water. Until we dedicate more regulatory effort and attention toward this crisis, we are going to be left fighting in the dark.

Plastic Pollution Is an Environmental Injustice

Plastic pollution poses greater harm to marginalized groups, according to the United Nations Environment Programme (UNEP). Where there is plastic, there will inevitably be microplastics. Low-income, rural, and Indigenous groups can be disproportionately affected by microplastic pollution due to fish-heavy diets and high exposure rates.⁶¹ Island and coastal communities can also fall into this category, particularly as ocean currents and wind patterns redistribute plastics onto shorelines.⁶² Two recent U.S. studies found that, compared to other demographic groups, communities of color more often purchase and consume bottled water, which could contain up to six times more microplastics than tap water.⁶³ One of these found higher rates of bottled water consumption among low-income communities, a conclusion corroborated by previous studies but not an ironclad pattern.⁶⁴

Even if these communities could avoid microplastic exposure and the health burdens that come with it, they would still be left at the mercy of plastic's toxic lifecycle. Across the U.S., the extractive system of plastic production and incineration contributes to "cancer alleys," where residents (disproportionately low income

and people of color) face toxic pollution — along with higher risks of heart disease, respiratory issues, and cancer.⁶⁵

Conclusion

Micro- and nanoplastics are a pervasive public health risk that currently evades regulation, and drinking water is a primary exposure route. Science suggests that what we know today is just the beginning. To take a meaningful first step in tackling this problem, the EPA must mandate public water systems to test for these tiny plastic particles. Ultimately, we need to cut microplastics off at their source by moving away from fossil-fueled plastics altogether.

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