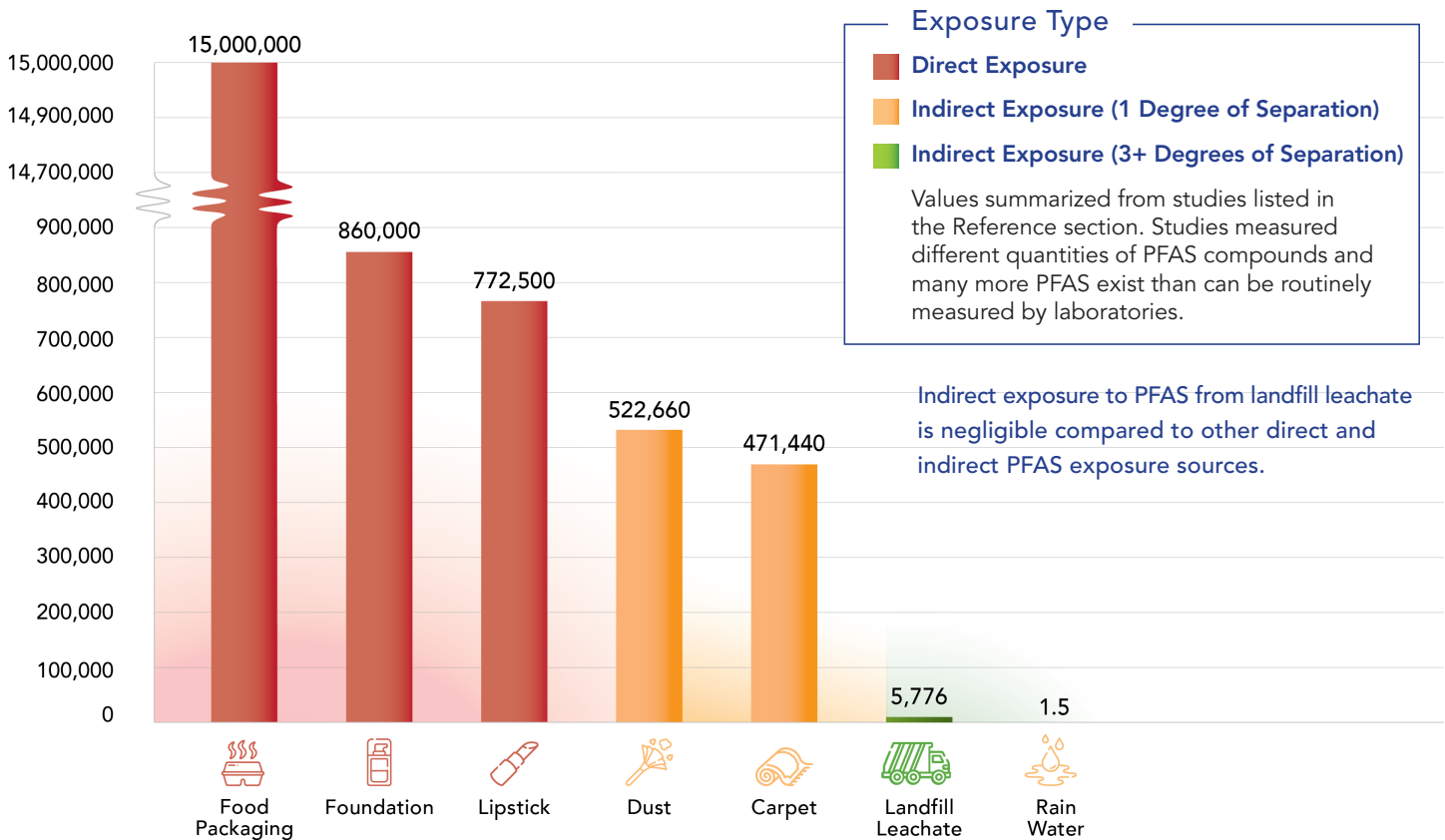


PFAS Concentrations and Exposures Factsheet

Understanding PFAS in Landfill Leachate Relative to Common Exposure Sources and Pathways

Total Median PFAS Concentration (ppt)



Understanding Common PFAS Exposure Sources, Pathways, and Concentrations

The use of per- and polyfluoroalkyl substances (PFAS) has grown rapidly since its discovery in the early 1930s. As the unique properties have been leveraged to add heat resistance, oil repellency, and waterproof benefits to a wide range of consumer products, these same properties have been the reason PFAS have been found in various media and environments, including in our homes and places of work.

Use of PFAS in many consumer products has resulted in management complexities for public service sectors that responsibly manage our collective waste streams. The municipal solid waste landfill sector provides an

essential public service that ensures human health and the environment are protected by properly managing society's wastes. Landfills are similar to wastewater treatment plants as both are "passive receivers" of sanitary waste streams carrying PFAS, not manufacturers or users of these chemicals. These essential public services now have the burden of managing PFAS protectively in the face of growing public and regulatory scrutiny.

Given the presence of PFAS in many products found in municipal solid waste, PFAS make their way into landfill leachate. PFAS have been detected in landfill leachate at varying concentrations due to regional variations in wastes and climate. The total median PFAS concentration in U.S. leachate is 5,776 parts per trillion (ppt) with PFOA and PFOS combined representing 836 ppt.

Direct vs. Indirect Exposure to PFAS and Why This Matters

With the ubiquitous nature of PFAS in the environment and consumer products, it is important to understand the difference between “direct” and “indirect” exposure to PFAS and how levels of PFAS in landfill leachate compare to other PFAS-containing items we encounter through our everyday lives.



Direct exposure means the PFAS-containing item comes in direct contact with an individual whether it is via eating, breathing, or skin contact. For instance, there is growing information on the presence of PFAS in food packaging. PFAS were initially approved for use in food packaging in the 1960s and are now widely used for grease or moisture management and identified as a source for direct exposure through ingestion of foods that retain some of the PFAS from the packaging. Another common example of direct exposure is applying PFAS-containing lipstick and other cosmetics.



Indirect exposure means that PFAS are released from the product before exposing an individual. Carpeting is an example where indirect exposure is most likely across various age groups, including infants and toddlers. PFAS are applied directly to carpet for stain and water resistance, but become released from carpet fibers from walking across the floor, vacuuming, etc. The released PFAS compounds can be inhaled in indoor dust. This example shows an indirect exposure with *one to two relative degrees of separation* from the product and human.

It is not expected that PFAS from leachate would come into direct contact with a human given the management and treatment practices. Because landfills have limited public access and leachate is sent to treatment plants via tanker trucks or sewer lines, the potential for direct human contact to leachate is very limited. Therefore, landfill leachate is an example of indirect exposure with *multiple degrees of separation* from potential exposure. This management structure also reduces the direct exposure to other ecological receptors (e.g., fish).

Negligible Indirect Exposure from Leachate

Landfills commonly rely on wastewater treatment plants for leachate treatment. There leachate mixes with large quantities of wastewater from other sources, including our homes, is treated, and eventually discharged as an effluent that meets regulatory requirements. As displayed in the figure above, the indirect exposure of PFAS from leachate is negligible compared to other direct and indirect PFAS exposure sources. In addition, when comparing the concentration of PFAS in leachate to various consumer products, food, and food packaging, the concentrations of these items that can come into direct contact with consumers (as color coded in red) are typically *orders of magnitude higher*.

A study by Sunderland et al. (2019) points out that a majority of exposure of adults to PFAS is from ingestion of food. Studies in the U.S. have estimated that 66-72% of PFAS exposure is from diet. Cosmetics, dust from households, and carpets have also been shown to contain significant concentrations of PFAS. The concentration of PFAS in foundation ranged from 70,000 to 10,500,000 ppt (median: 860,000) and is a direct exposure potential. Meanwhile, carpet and dust are both associated with relatively high concentrations of PFAS and makes up between approximately 10-15% of daily exposure. Although carpet and dust are indirect exposures, the average American spends about 90% of their time indoors. These exposures will vary from person to person depending on personal choices and daily habits.

The indirect exposure of PFAS from landfill leachate is negligible compared to other direct and indirect PFAS exposure sources. Bringing awareness to the concentrations of everyday products versus the discharge of leachate from municipal solid waste landfills is important to understand the relative daily exposures of PFAS and where policymakers and regulatory agencies should focus their attention and resources to minimize public exposure.

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