

Emerging Threats to Public Health

PFAS and Micro-, Nano-Plastics in Drinking Water, Foods, and Air

Stephen C Brown November 30, 2023

PFAS

Per- and Poly- Fluoro Alkyl Substances

- **Definition:** Different Class definitions, subsets of some 15,000 chemicals
 - EPA: “at least two adjacent carbon atoms, where one carbon is fully fluorinated and the other is at least partially fluorinated”, until further notice. Compare to ECHA, per REACH authority
- **Shared Properties:** Bioaccumulative, Persistent, and Toxic (*chronic v. acute* exposures)
- Manufactured since 1938, introduced widely into basic consumer goods in 1950:
 - ScotchGuard™ (PFOS)
 - Teflon (PFOA)
 - AFFF Class B (many)
 - Cosmetics, GoreTex™, Toilet Paper, Lubricants, Car Washes, Cleaning Products,

Micro- to Nano-Plastics (MNP)

Degradation of plastic litter in the environment

- **Definition:** *Micro-* (less than 5 mm); *Nano-* (less than 1 μm (micron))
- **Sources** from ~430 Million Metric Tons (MMT) produced annually:
 - Tire Wear ~50%
 - Disposable, single-use plastics degraded in the environment (~300 MMTs annually)
 - Clothing, fabrics (~60% from plastics)
 - *Nurdles* used as manufacturing materials
 - Manufactured *Microbeads*-first introduced in 1960's, banned in 2015
- **Fate**
 - *Ingested and Inhaled* at roughly equal amounts: ~450 peer-reviewed publications per year
 - Around 400 $\mu\text{g}/\text{kg}\text{-bw}/\text{d}$ in preschoolers, e.g. [eBioMedicine 2023;97: 104828]

Regulation

Slow and Ineffectual-resistance from Manufacturers and Regulatory Capture

- **United Nations**
 - PFAS as a class of Persistent Organic Pollutants-*POPs* regulated by the Stockholm Convention
 - MNPs through UNEP- see *From Pollution to Solution*, 2021 report. Treaty proposal by 2024
- **European Union** leading, through **REACH** authorization and implemented through **ECHA**
- **Congress has never authorized EPA and the FDA to fully protect human health**
 - **TSCA reform** required, but States can do a lot through Clean Water Act NPDES
 - See [Safer States](#) website for details of State legislation on PFAS and MNPs
- **Local Governments** will have increasing responsibilities to address PFAS pollutions

Potential PFAS Liabilities for Ann Arbor

EPA broadens testing UCMR(5) and issues new rules and regulations to limit exposures to PFAS

- **Drinking Water**

- Michigan MPART program- City installs new GAC filtration to trap PFAS ✓

- **Wastewater (and Stormwater?)**

- EPA requests PFAS analyses as part of renewed NPDES permit (Dec. 6, 2022)
 - Reducing PFAS inputs to sewer system is optimal strategy
 - Pretreat legacy landfill leachate
 - Investigate potential point sources (car washes, UM, AAPS, etc.)
 - Reduce general consumer products containing PFAS

- **Biosolids**

- Grostick Farm example. City has voluntarily re-directed sewage sludge to landfills in early 2023