PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) THE AIR QUALITY PATHWAY

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OVERVIEW



Brief Overview on PFAS and AQ Pathway

Evolving Regulatory Landscape

PFAS Fate and Transport Case Studies: Surface Coating Operation / Landfill Gas



PFAS ARE AMONG THE MOST SIGNIFICANT ENVIRONMENTAL REGULATORY DEVELOPMENTS IN THE LAST 40+ YEARS

PFAS are in books



PFAS are in the news

PFAS are in social media





PFAS are in the movies



PFAS HAVE NUMEROUS USES IN INDUSTRIAL, COMMERCIAL, AND CONSUMER APPLICATIONS



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WHAT DO WE MEAN WHEN WE SAY "PFAS"?

"There is no precisely clear definition of what constitutes a PFAS substance given the inclusion of partially fluorinated substances, polymers, and ill-defined reaction products on these various lists."

- U.S. EPA, Master List of PFAS Substances



THE LIFE CYCLE OF PFAS IS COMPLEX



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Air, wastewater, stormwater, groundwater, surface water, sediment, landfills

THE LIFE CYCLE OF PFAS IS COMPLEX



WHY DO WE CARE ABOUT PFAS AIR DISPERSION AND DEPOSITION?



Air emissions and aerial deposition responsible, in part, for observed contamination



RECENT REGULATORY UPDATES

- State Efforts
- TSCA: PFAS Reporting Rule
- EPCRA/TRI: Removal of *De minimis* Exemption for PFAS
- Petition to EPA for HAP Listing
- Measurement/Modeling

STATE EFFORTS TO REGULATE PFAS IN AIR QUALITY

State	PFOA Concentration (µg/m ³)	Averaging Period
Michigan	0.07	24-hour
Minnesota	0.063	24-hour
New Hampshire*	0.05 0.024	24-hour Annual
New York	0.0053	Annual
Texas	0.005	Annual

 * Denotes a value for ammonium perfluorooctanoate, a precursor to PFOA

Look for other states to begin regulating PFAS and for the list of regulated PFAS to increase.





TSCA PFAS REPORTING AND RECORDKEEPING RULE

- EPA authority under TSCA Section 8(a)(7)
 - Mandated by Congress in 2020 National Defense Authorization Act (NDAA)
 - Codified at 15 U.S.C. 2607(a)(7)
- Final rule in 48 Federal Register pp. 70516-70559, Wednesday, October 11, 2023
 - Codified at 40 CFR Part 705

TSCA PFAS REPORTING AND RECORDKEEPING RULE

Rule Summary

- One-time reporting
- Applicable to companies who manufacture (including import) or have manufactured (including imported) PFAS for commercial purpose in any year between 2011 and 2022
- Importers of PFAS in articles are considered PFAS manufacturers under this rule
- No *de minimis* or product use (*e.g.*, impurities, test marketing, R&D, etc.) exemptions
- EPA issued a structural definition for PFAS to avoid limiting the scope using a discrete list any substance that meets the structural definition, including fluoropolymers, are subject to the rule
- Very complex rule with potential² lengthy time needed to gather information (supply chain considerations)
- Reporting deadline for most facilities = January 11, 2026



TOXIC RELEASE INVENTORY CHANGES

- In November 2023, USEPA removed the *de minimis* exemption, which is expected to significantly expand the number of facilities that must report releases of PFAS
 - Still only need to report individual PFAS chemicals that exceed the 100 lb/yr threshold
 - Applicable to chemicals that are *manufactured*, *processed* and *otherwise used*
 - No testing/sampling required, but facilities should document their analysis
 - Suppliers are required to disclose PFAS
- RY2024: 196 PFAS are reportable (7 added)
- RY2025: 9 PFAS added to TRI list
- Oct 2024: Proposed to add 16 PFAS and 15 PFAS categories representing over 100 individual PFAS





STATES PETITION EPA TO DESIGNATE AS HAZARDOUS AIR POLLUTANT

- In August 2024, three states (NJ, NC, NM) petitioned EPA to request 4 PFAS chemicals be regulated as hazardous air pollutants:
 - PFOA (perfluorooctanoic acid)
 - PFOS (perfluorooctane sulfuonic acid)
 - PFNA (perfluorononanoic acid)
 - GenX (HFPO dimer acid)
- If deemed HAP, what happens?
 - Benchmarking to identify industries subject to MACT
 - Direct manufacturers most likely everyone else probably area source
 - TRI results will help identify
 - Rule development



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CAN WE MEASURE AND MODEL PFAS IN AIR?

Air Dispersion Modeling

- Air emissions and deposition often play an important role in PFAS contamination
- Considerable uncertainty in the atmospheric deposition properties of several PFAS
- Characterization of PFAS aerial deposition requires specialized expertise and careful application of data and methods
- Long-range transport of PFAS can introduce non-local (background) contributions to a site

Measurement Methods

- Draft Methods OTM-45 (semi-volatile/condensable) & OTM-50 (volatile)
- OTM-55 in development (add'l semi-volatile)

The combination of measurements and modeling of deposition can be a powerful tool to understand the contribution, or lack thereof, of air emissions to observed contamination

ENVIRONMENTAL SAMPLING RESULTS: CURRENT CONDITIONS

LEGACY OPS: ~37



RECONCILIATION OF ENVIRONMENTAL SAMPLING RESULTS TO ESTIMATES



EXAMPLES OF COATING AGGLOMERATION AND CHUNKING



Coating Agglomeration on Inside of Stack Cap

≤17,200,000 ng/Kg PFOA

Residue Under Roof Ballast

Roof Ballast and Roof Stack

PFAS Residue in Roof Ballast from Chunking of Coating Agglomeration Occurring in Stacks ≤13,000,000 ng/Kg PFOA

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FINDINGS AND CONCLUSIONS

01

Agglomeration of PFOA-containing coatings in stack components during Legacy Ops tenure have resulted in the release of significant PFOA mass in residual coatings to the roof, which have served as a major source of PFOA for decades until roof replacement.

02

Emissions and mass of PFOA released by Legacy Ops were exponentially greater than Current Ops, resulting in commensurate greater PFOA mass transport from Legacy Ops compared to Current Ops via the pathways shown.

03

The measured concentrations in the environment on site and at the Public Water Supply Well cannot be reconciled to Current Ops.

04

Multiple lines of evidence (at least 5) point to Legacy Ops as the source of the PFOA observed in media around the facility and at the Public Water Supply Well with the potential for de minimis contributions from Current Ops.



PFAS AIR EMISSIONS FROM LANDFILL GAS

- Sampling at three MSW landfills in FL for 27 neutral PFAS compounds
- Key findings:
 - 13 neutral PFAS observed, primarily fluorotelomer alcohols, acetates, olefins and acrylates
 - The mass of total fluorine leaving in landfill gas (32-76%) is comparable to that leaving in leachate (24-68%)
 - Landfill gas is a significant pathway for introducing PFAS into the environment

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Landfill Gas: A Major Pathway for Neutral Per- and Polyfluoroalkyl Substance (PFAS) Release. Environ. Sci. Technol. Lett. Lin, A.M. et al. June 26, 2024.

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