

PFAS in Air: Likely Future Regulatory Focus, But What Sources are Most Important?

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The PFAS “breather” afforded by the change in EPA’s administration allows us (as promised) to return to thoughts of PFAS in air (pun intended). What are the concerns over PFAS in air, and what issues should be examined?

Indoor air research suggests that [inhalation is a potentially important PFAS exposure pathway](#), and it may grow in importance as regulatory compliance diminishes exposure from drinking water. However, even though [indoor air quality is an important source of exposure to many air pollutants](#), EPA’s Clean Air Act mandate focuses on outdoor air. Consequently, EPA has published [OTM-45](#) and [OTM-50](#) for measuring PFAS in source emissions, but there are no federal requirements for their use. Some sources have voluntarily applied these methods, and not surprisingly, have found PFAS at detectable levels. One of the challenges of PFAS is that they can be detected at very low levels, making it difficult to distinguish between emissions that are potentially consequential or of de minimis concern.

With apologies, this blog goes into the weeds on some “ballpark” calculations that are designed to explore questions on air emissions and their importance. One central theme is current emissions vs. past emissions, as there have been changes in the PFAS used in commerce as well as air pollution control efforts made in response to PFAS awareness/focus. Another issue centers on PFAS of concern. Much of the regulatory attention has focused on PFOA and PFOS, but [fluorotelomer alcohols \(FTOHs\) are important to air emissions due to their volatility](#).

A first point is to dispel the myth that PFAS are not destroyed by combustion. [Recent tests at hazardous waste combustors](#) have demonstrated very high destruction and removal efficiencies, but even combustion processes at lower temperatures and residence times are capable of destroying PFAS. As an example, a research team including Sanborn Head [recently tested a landfill gas flare](#) and detected 99% less PFAS in post-combustion emissions. Definitive PFAS destruction was lower at >80% due to limitations on stack testing detection limits, a lesson learned for those that want to demonstrate high destruction and removal efficiencies (one needs to spike PFAS rates into the device), but we suspect the destruction rates were closer to the 99% difference in the detectable PFAS.

Non-combustion sources are (or were) probably larger sources. EPA and several state environmental agencies have attributed localized groundwater contamination to historical PFAS emissions from industrial sources. So-called [atmospheric deposition sites](#), at which PFAS from air emissions are deposited to the ground and continue to leach at measurable levels to groundwater, have been identified around industrial facilities that manufactured and/or used PFAS. PFAS emissions at these sites do not need to be “large” with respect to regulatory criteria. For example, [a 2007 modeling study at Dupont’s Washington Works facility in Parkersburg, West Virginia](#) estimates air emissions averaged 6.6 tons/year over the 53 year period from 1951 to 2003, with peak emissions reaching 17 tons/year. At the time, these emissions were regulated as particulate matter, and were well below the major source threshold of 100 tons/year for a criteria pollutant. Regulatory agencies are viewing these emissions to be of greater significance given their [potential to contaminate drinking water wells at interpreted distances as far as 20 miles from the facility](#).

Past source contribution to the global distribution of PFAS is an important consideration when evaluating the importance of present-day emissions. For example, the detection of PFAS in municipal waste combustor (MWC) ash indicates environmental emissions. A ballpark emissions estimate of 0.0002 lb/yr can be generated from an [average measured concentration of PFAS in flyash \(18.4 ng/g\)](#), the measured particulate matter concentration in stack emissions (1.97 mg/m³, based on [26 stack tests at MA facilities in 2023](#)), and the stack-gas flowrate for a typical MWC processing 1,500 tons of waste per day (90 m³/s). At this level, it would take about 60,000,000 years of MWC operation to match an

average year of the Dupont facility's emissions. Moreover, "background" concentration of PFAS in soils of the order of 1 µg/kg in measured in surface soils of several New England states imply the presence of more than 40 tons of deposited PFAS based on assumptions of 62,000 square miles of land area, a mixing depth of 6 inches, and bulk soil density of 1,600 kg/m³. MWC emissions of 0.0002 lbs/facility, even if deposited *in toto* to soils in New England, will not substantially increase existing background levels. These calculations suggests that current emissions from sources such as MWCs are not substantially increasing the environmental burden of PFAS, and this example provides a possible framework for evaluating the importance of other PFAS emission sources.

However, recent PFAS measurements in rainfall in a Wisconsin study suggest some sources may be contributing to PFAS concentrations in air. GenX (HFPO-DA) was the PFAS found at the highest concentration (average median of 0.34 ng/L across 8 stations), which is considerably lower than found near a manufacturing facility in North Carolina. The measured concentration of 0.34 ng/L is also well below EPA's Lifetime Health Advisory of 10 ng/L, suggesting that air emission sources are not contributing to widespread transport and deposition of GenX at levels of concern. Consistent with this premise, GenX has only been detected above EPA's Health Based Concentration (HBC) of 10 ng/L in 0.12% of public water systems sampled in EPA's UCMR5 survey (10 out of 8,670 PWSs sampled). Therefore, it would appear that the presence of Gen X in air has a minimal impact on groundwater and surface water drinking water quality.

A variety of other PFAS were also found in the rainfall study, including PFOA at an average median concentration of 0.18 ng/L. Authors of the West Virginia study that measured PFOA in both rainwater and air found a median rain:air washout ratio of 125,000. Combined, these values imply a PFOA concentration in air of 0.000145 ng/m³ in air, which is likely undetectable by current analytical methods and several orders of magnitude smaller than state-derived standards such as New York's Annual Guideline Concentration of 5.3 ng/m³. One possible source of PFOA is resuspension of surface soils, since PFOA in air is predominantly associated with particles. However, a typical particulate matter concentration of 10 µg/m³ implies a PFOA concentration of 145 ng/g in the particles, which is much higher than the typical background concentration of 0.3 ng/g PFOA detected in New England soils, indicating that the PFOA in rainwater is not likely due to soil resuspension, but rather results from other sources. Thus there may be active or residual sources of PFOA emissions. There could also be contributions from volatile PFAS emissions of fluorotelomer alcohols (FTOHs), which are likely released from sources such as wastewater treatment plants and landfills, and have been shown to convert in the environment to stable perfluorinated carboxylic acids. Regardless of the contributing source(s), depositing 1.14 m of rainwater containing 0.18 ng/L into the top 6 inches of soil will increase the PFOA concentration in surface soil (bulk density 1600 kg/m³) by 0.00084 µg/kg each year. At this rate, it would take about 350 years to double the present-day background concentration of 0.3 ug/kg found in New England surface soils. By then, PFAS emissions to air may be substantially decreased.

If you have endured this far, it should be obvious that there is much to learn about PFAS in air. We apologize for taking liberties on mixing/matching types of PFAS, as well as measurements taken at different locations, but these order of magnitude examples suggest to us the importance of examining present day sources of PFAS emissions to air in the context of historical sources. It will be interesting to see how EPA's reorganization and funding cuts affect further research on PFAS air emissions, and how we move forward with the assessment of PFAS in air.