Tool 2.3: Guide to PFAS Fate and Transport in Air

The following document describes the mechanisms by which PFAS may be transported in air and the factors determining its eventual fate.

Per - and Polyfluoroalkyl Substances (PFAS) in Air
Characteristics of the Released PFAS
Relevance: Determines the tendency of each individual released PFAS compound to partition and get transported via air in gaseous form or absorbed on particulate matter**.**
Specific factors to be evaluated and their effect on PFAS fate and transport: ***Vapor pressure*** – The higher the value, the more volatile a compound is. While most PFAS compounds are less volatile, having lower vapor pressure, some classes of PFAS such as alcohols (for example, fluorotelomer alcohols or FTOHs) are more volatile and expected to partition into air as gases. Anionic species are less volatile than their acidic counter parts and their presence in environment is potential hydrogen (pH) dependent with acidic forms being dominant only at low pH values (Kaiser et al., 2010). The less volatile PFAS compounds may still partition and travel in air via partitioning on dust particles and aerosols. ***Henry's Law Constant*** – Establishes the propensity of a compound to partition into water or air. Most PFAS compounds have the tendency to partition into water. ***Specific information*** – Several practical observations have been recorded such as: • Perfluorooctanoic acid (PFOA) seems to be dominant in smaller ultrafine particles in air. • Perfluorooctanesulfonic acid (PFOS) seems to be dominant in larger, coarser particles (Dreyer, et al. 2015) (Ge, et al. 2017). • Anionic PFAS were reported to partition into airborne aerosols and other small particulates.

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• PFOA may be released as gaseous form in specific conditions, such as following agitation of Aqueous Film-Forming Foams (AFFF). However, the veracity of PFOA detection in the gas phase is not well established and has been debated (Titaley, De la Cruz and Field 2020).
• In workplace air, more PFOA was shown to partition to air from dry surfaces than from water (Kaiser, Dawson, et al. 2010).
Release Type
Relevance: Establishes if released PFAS contacted with air as well as the amount of released PFAS.
Specific factors to be evaluated and their effect on PFAS fate and transport: General ***<u>types of releases</u>*** that may generate more significant amounts of PFAS in the air include: • Fire suppression and AFFF applications; • Spray applications (e.g., of insecticides, pesticides, paints, and other products containing PFAS).
Environmental and Weather Conditions
Relevance: Establishes the distance and direction of PFAS migration via air.
Specific factors to be evaluated and their effect on PFAS fate and transport: ***<u>Soil pH in the release area</u>*** – Lower pH environments were shown to be contributing more PFOA mass to air since the acid form of PFOA has an elevated vapor pressure (Kaiser, Larsen, et al. 2005). ***<u>Composition of atmospheric gases</u>*** – Specifically, the ratio of nitrous oxides (NO_x) and peroxy- radicals (RO_2) species may determine the atmospheric yields of long-chain perfluorinated carboxylic acids (PFCA) from precursor compounds such as FTOHs, with high ratios resulting in lower long-chain PFCA yields (Young and Mabury 2010).
<u>Wind</u> – The prevailing winds during the PFAS release influence the direction and distance of airborne PFAS transport.

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Precipitation – Removes PFAS from the atmosphere and transports PFAS into subsurface environments. If precipitation occurs during a PFAS release, it may prevent atmospheric transport of released PFAS, while enhancing subsurface PFAS vertical migration and leaching.