From Emission to Inhalation: Occurrence, Composition, and Health Risk of Per- and Polyfluoroalkyl Substances in the Ambient Air of Ho Chi Minh City, Vietnam

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Abstract

Per- and polyfluoroalkyl substances (PFASs) are synthetic compounds prized for their resistance to heat, water, and chemicals, yet often referred to as "forever chemicals" due to their persistence, long-range transport potential, and bioaccumulation. Evidence suggests PFASs can disrupt endocrine function, suppress immunity, and increase cancer risks. This study examined the distribution and potential health risks of 40 PFASs in the outdoor atmosphere of Ho Chi Minh City, Vietnam, based on quarterly air sampling at five sites: three residential areas, one pagoda, and one university. Results showed high levels of PFAS precursors, notably 6:2 fluorotelomer sulfonate and N-ethyl perfluorooctane sulfonamidoethanol, with concentrations ranging from 0.04 to 22.6 ng/m³ and 0.02 to 5.75 ng/m³, respectively. Seasonal comparisons revealed no major differences between rainy and dry periods, suggesting stable emission sources. Principal Component Analysis and Backward Trajectory Analysis indicated contributions from both local and regional origins. A health risk assessment, based on estimated daily inhalation intake and hazard quotient (HQs) values for 13 PFASs, found that HQs for toddlers and adults were substantially below one by several orders of magnitude, indicating negligible non-carcinogenic risk under current conditions. These findings highlight the ubiquity and persistence of airborne PFASs in urban environments and underscore the need for continued monitoring and regulatory attention, even where immediate health risks appear low.

Keywords: PFASs, outdoor air, source, risk assessments