

**Title:** PFAS risk assessment: Picking up the pieces

Supervisor: Jan Hendriks and specific experts (e.g. from RIVM).

**Setting:** After more than half a century of problems with persistent organic pollutants (POPs) of a chlorinated (e.g., DDT, PCB) or brominated (e.g., PBDE) nature, societal attention has now shifted to fluorinated substances, in particular per- and polyfluoroalkyl substances (PFAS).

**Gaps:** Empirical research in the last two decades has yielded anecdotal data but risk assessment is difficult due to the large number of congeners (over 3000) and species to be addressed.

**Objective:** Hence, the aim is to 1) select processes and patterns dominating environmental fate, accumulation and effects of PFAS, 2) collect mechanistic and statistical relationships for these phenomena as a function of chemical properties and biological traits, 3) parameterize existing models for POPs by incorporating these relationships, 4) test these models for risk assessment in specific cases."

**Methods:** 1) qualitative review of processes and patterns, 2) quantitative meta-analysis of relationships, 3) implementation in simple models (esp. SIMPLEBOX, OMEGA), 4) application to hot-spots.

**Expected results:** The outcome will typically be overviews of processes, patterns, relationships and cases as previously studied for legacy POPs (DDT, PCB, PBDE) and improvements needed to cover PFAS specific issues, in particular 1) amphiphilic air-water-soil partitioning (partial Kow), 2) electrostatic protein- in addition to van der Waals/hydrogen bond lipid driven accumulation [Zhang et al. 2009], 3) typical/dominant mode of action (ROS?), 4) variability in external vs. internal effect concentrations, 5) additional chemical descriptors like chain length

While multiple congeners will be covered by extrapolation methods like quantitative structure activity relationships (QSAR), toxic equivalency factors (TEFs) etc., we will first focus on prominent congeners, like PFOS PFOA in soils and sediment PFBA in water. As selection of topics and substances will be made depending on the background (chemistry, toxicology, ecology) of the student and length of the study (BSc, MSc, PhD)."