

What Biota Data Can Be Adequately Approximated from Existing Risk Assessment Tools for PFAS?

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Background. Per- and poly fluoroalkyl substances (PFAS) are well understood to bio-accumulate and have been detected within a diverse number of biota, particularly within areas where aqueous film forming foams (AFFFs) were historically used. Due to the potential for cumulative exposure, consideration of a variety of biota is often necessary. Within current risk assessment frameworks, there are a number of methods for estimating concentrations within biota based on mathematical estimations of uptake into biota. The aim of this paper is to determine, based on the largest dataset of PFAS environmental data, which biota is able to be mathematically estimated with confidence from environmental media, and those media in which such an approach results in poor estimates therefore necessitating the need for sampling.

Approach. The Australian Department of Defence has the largest portfolio of PFAS impacted sites in which significant amounts of environmental media, including biota, has been collected. This data set is unique and diverse as it covers thirteen of the Defence sites where biota samples were collected which are located within a myriad of different climatic and geological settings. A review of this database has been conducted with consideration of biota samples including, but not limited to, grass, plants, fruit, vegetables, eggs, livestock meat (beef), fish (marine and fresh) and dairy milk, as well as co-occurring environmental media concentrations for groundwater / borewater, pore water, soil and sediment from the Defence sites across Australia. Modified intake equations were adopted to estimate concentrations within eggs, beef muscle, vegetables, fruit, livestock milk and fish to compare to sampled media.

Results. The project involved detailed comparison of direct and estimated biota concentrations across the thirteen Defence sites where biota samples were taken. The comparison showed which media were suitable for the application of calculated PFAS estimates and which media may require sampling due to geographical variations in PFAS uptake.

- The large environmental data sets available from the Defence investigations were used to estimate PFAS concentrations within biota. These estimates considered statistical approaches where the data was amenable.
- A comparison of the actual biota sample concentrations per site and on a national level was undertaken to determine the confidence in mathematical estimates compared to direct measurements.

Site-specific data are the most valuable, however it is not always possible or practical to collect. This work determined where reliable estimates of PFAS concentrations can be initially considered from a theoretical approach. This results in a pragmatic approach to field sampling programs to inform risk assessments.