Food Web-Based Computational Tool to Estimate PFAS Risk to Human Health

Dredging Operations Environmental Research (DOER) Program

U.S. ARMY CORPS OF ENGINEERS BUILDING STRONG®

Focus Area

Risk Management

Problem

As new water quality regulatory limits emerge for per- and polyfluoroalkyl substances (PFAS), science-based PFAS risk characterization protecting human health from sediment-associated PFAS is urgently needed to inform management of dredging operations. As a worst-case scenario, overly-conservative management decisions lacking scientific realism may lead to the cessation of dredging in key navigational channels leading to impacts on commerce and national security.

Study Description

We will develop a food web-based computational tool to estimate PFAS risk to human health from dredge material. In **Task 1**, the conceptual model for PFAS food web-based human risk tool will be developed. To accomplish this, we will conduct a broad-scope literature review to gather studies, reports, dredging evaluations, and models to enable understanding of PFAS contamination in aquatic sediments targeted for dredging operation. From this literature we will develop the overall conceptual model for the food-web based tool for establishing human from dredged material. In **Task 2**, we will characterize dredged material for PFAS exposure, accumulation, trophic transfer and human health thresholds to connect PFAS exposure levels to human health effect thresholds originating from fish consumption. In **Task 3**, modeling of PFAS bioaccumulation and trophic transfer in freshwater aquatic food webs will be conducted. A survey of existing aquatic freshwater food web models, evaluating their purpose, motivations, and suitability for or potential to support PFAS risk assessment. Our modeling approach will involve synergizing the bioconcentration factor (BCF) / bioaccumulation factor (BAF) paradigm implemented in smaller, more sensitive organisms (e.g., benthic invertebrates) with existing ordinary differential equations (ODE) based toxicokinetic models which accurately describe PFAS concentrations in small and large fish species. In **Task 4**, the food web-based PFAS risk to human health prediction tool will be finalized and transitioned for use by the dredging risk assessment community of practice. Specifically, the objective of this task is to establish a user-facing interface for the PFAS food web model and provide a training session for how to use the tool.

Products

The principal product of this work will be an integrative food-web modeling tool connecting PFAS concentrations in dredged sediments targeted for aquatic placement, including beneficial use of dredged material (BUDM) applications, to bioaccumulation and trophic transfer in biota with humans as apex consumers to detect if human health thresholds are exceeded in realistic dietary exposures.

Summary

The food-web model developed to estimate the human health risk associated with PFAS contamination in dredged sediments will directly support the Great Lakes region by providing quantitative risk characterization tool to support risk-management decisions for dredged material placement in aquatic environments, including BUDM applications. Access to high quality science-based risk characterization information for dredged sediments will greatly increase the frequency in which decision makers can confidently choose to use dredged materials as BUDM when, otherwise, only a precautionary principle may be available, given existing uncertainties surrounding PFAS health risk. Consequently, the USACE goal of applying 70% of dredged sediment in BUDM applications is more likely to be met while simultaneously establishing improved environmental stewardship and human health protection.

Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

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Research Products

Product Type	Product Title

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