SUSTAINABLE & HEALTHY COMMUNITIES RESEARCH PROGRAM

**Evaluating the Relationship between Equilibrium Passive Sampler Uptake and Aquatic Organism Bioaccumulation - SHC 3.61.3**

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**Purpose/Utility of Research**

For decades, biomonitoring organisms have been used to assess the bioavailability of contaminants of concern (COCs) at contaminated sediment Superfund sites across the country:
- evaluating remedy effectiveness
- pre- and post-remediation monitoring

Passive samplers* have been used to measure the freely dissolved concentration ($C_{free}$) of COCs in the water column and sediment interstitial waters.

Recently, use of passive samplers as surrogates for biomonitoring organisms has been proposed for scenarios where organisms cannot be deployed or are not available.

However, no comprehensive review has been performed to evaluate the strength of the relationship between passive sampler uptake and organism bioaccumulation.

**Highlights**

- Based on an extensive literature review, 57 studies were found where both passive sampler uptake and organism bioaccumulation were measured, 19 of these investigations provided direct comparisons relating passive sampler uptake and organism bioaccumulation.
- When bioaccumulation and passive sampler uptake were compared in the three types of passive samplers, predictive linear relationships were observed:
  - Mean coefficients of determination ($r^2$) for SPME, LDPE and POM were 0.76, 0.68 and 0.58, respectively.
  - Passive samplers accumulated COCs predictively when compared to biomonitoring organisms.

**Application & Translation**

This work has resulted in two publications demonstrating the credibility of the research and its findings:


In addition, this work contributed to a recent National Association of Remedial Project Managers (NARPM) workshop:


**Intended End users**

Office of Superfund Remediation and Technology Innovation (OSRTI) and the Regions are the primary end-users of this research.

Colleagues in OSRTI and the Regions have provided useful input on ORD’s passive sampling research.

**Lessons Learned**

- This research demonstrates that in cases where biomonitoring organisms are not available or cannot be deployed at contaminated sediments Superfund sites, passive samplers can be used as reliable, cost-effective, and reproducible surrogates.
- In addition to showing that passive samplers are reliable tools that complement conventional biomonitoring, this research advances the science by expanding the applications of passive sampling beyond the determination of $C_{free}$.

* SPME = Solid phase microextraction; PE = Polyethylene; POM = Polymethylmethacrylate