ESTCP Project: Sediment Bioavailability Initiative (SBI)—Development of Standard Methods and Approaches for the Use of Passive Samplers in Assessment and Management of Contaminated Sediment

Exponent®

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Project Team

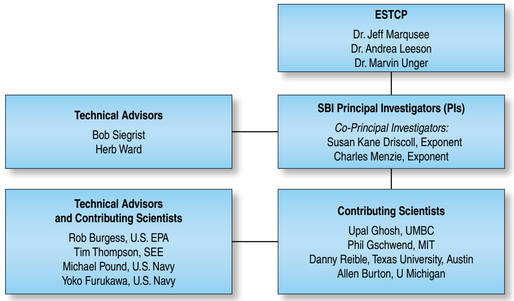


Figure 1. Project team

Problem Statement

- Bioavailability of chemicals in sediment is recognized as a critical aspect for exposure, risk, and management
- Passive samples could provide the means for measuring bioavailability during assessments and remediation
- The use and benefit of these tools would be greatly enhanced if practitioners, remedial project managers, and regulators were better informed about the tools' utility, standardization of methods, and associated strengths and limitations.

There is a need to move from insights, research, and general guidance to specific guidelines and actions (Figure 2).

Figure 2. Examples of current guidelines

Technical Objective

- Publish standard methods in collaboration with U.S. EPA
- Develop an Integrated Assessment/ Management Framework that demonstrates how to use information on bioavailability in assessing and managing exposure
- Provide outreach and support for use of passive samplers in remedial decision making (Figure 3)

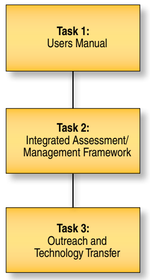


Figure 3. Technical objectives—Tasks 1–3

Technology Description

- Solid-phase materials that accumulate contaminants and reach equilibrium with surrounding water
- Used to quantify concentrations of "freely dissolved" contaminants (e.g., not bound to particulates) in sediment ($C_{pore\ water}$) or surface water (Figure 4)
- $C_{pore\ water}$ correlates well with potential for bioaccumulation by sediment-dwelling organisms (Figure 4)

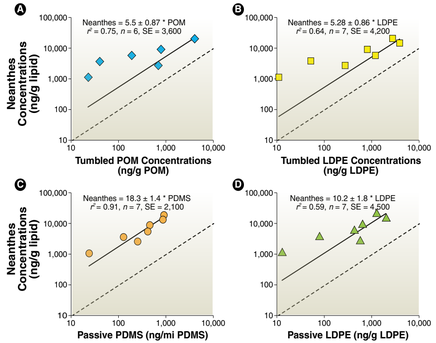


Figure 4. Correlations of PCB concentrations in passive samplers (A: POM, B: PE, C: SPME fibers, or D: PE) to concentrations in tissue (Gschwend et al. 2011)

Types of Passive Samplers

- Provide information on actual field conditions during assessment and remediation
- Will be especially useful for supporting capping, reactive caps, core mats, and *in-situ* remedial technologies (Figure 5)

Figure 5. Types of passive samplers

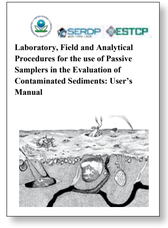
Technical Approach

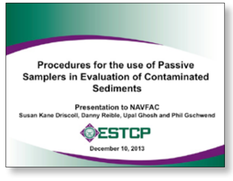
The Sediment Bioavailability Initiative (SBI) is a product-oriented approach that seeks to develop tools for building an accepted standard of practice for the use of passive samplers in sediment management.

Technology Transfer

Upcoming Activities:

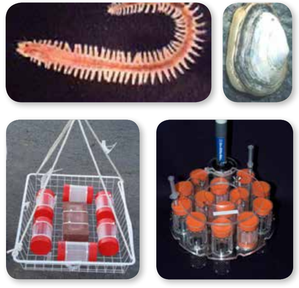
- Joint ESTCP/ EPA User's Manual (2015)
- Integrated Assessment Framework (2015) with distribution to state and other federal regulators and other interested parties for review
- Presentation at National Environmental Monitoring Conference (August 2014, Washington DC)
- SETAC short course on use of passive samplers for sediment assessment (November 2014, Vancouver, BC)
- Potential participation in 2015 NAVFAC Open Environmental Resource (OER2) Webinar





Past Activities:

- Webinar presentation to NAVFAC (December 2013)
- Participation in 2012 SETAC Pellston workshop on use of passive samplers in sediment assessment
- Publication of series of Pellston papers in Integrated Environmental Assessment and Management
- Presentations on Sediment Bioavailability Initiative at SETAC (2012, 2013) and Battelle (2013) conferences
- Outreach to DoD's Environmental Data Quality Work Group

Expected DoD Benefits

- Reduce uncertainty around remedial decisions and provide confidence that the "right thing" is being implemented
- Substantially reduce costs of sediment remediation by:
  - Reducing footprints and volumes
  - Enabling the use of remedial technologies other than excavation/ dredging
- Support of smaller and/or less aggressive remediation would lower unintentional impacts and natural resource damages
- Low cost of samplers (e.g., minimal to $100s per sampler) and chemical analysis (no complex extractions)
- Lower cost to deploy and collect samples (25%–40%)
- Potential to screen out areas and eliminate cost of further characterization (e.g., $2,000–$5,000 per sample for sediment toxicity and bioaccumulation tests)
- Lower cost per sample = higher quality delineation = enhanced environmental protection = reduced regulatory delays