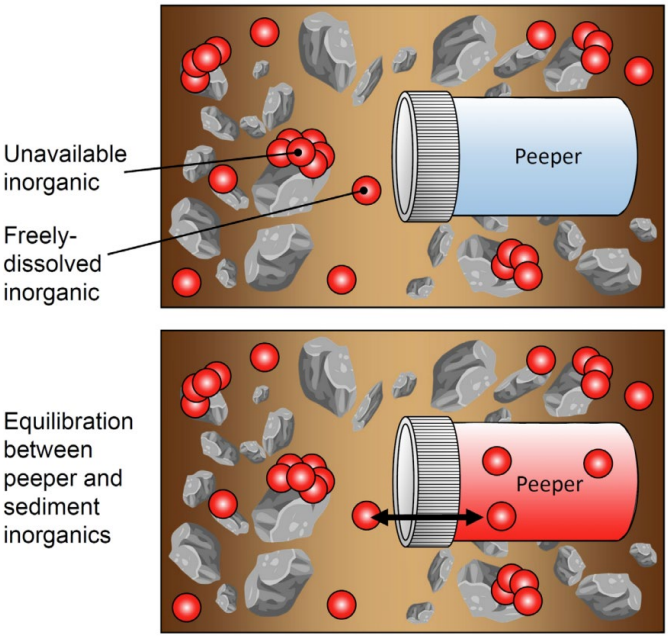
CRITICAL FINDINGS

Standardizing Sediment Porewater Passive Samplers for Inorganic Constituents of Concern

ER20-5261 | December 2021

PROJECT OBJECTIVES

Standardize approaches for measuring metal availability in sediment using dialysis samplers ("peepers")



EXPECTED OUTCOMES

- Detailed literature review of the past 45+ years of peeper research
- Laboratory optimization of peeper design and methods
- Field demonstration of the technology
- Procedures and guidance for end-user community

SEDIMENT POREWATER DIALYSIS PASSIVE SAMPLERS: "PEEPERS"

- Small compartment containing ultra-pure water that equilibrates with sediment porewater via passive diffusion through a semipermeable membrane
- Deployment in situ for days to weeks for chemical equilibration
- Retrieval and chemical analysis to quantify concentration of peeper solution and thus, concentration of the porewater
- Concentration correction using reverse tracers if deployment time not sufficient to reach equilibrium

TECHNOLOGY ADVANTAGES

- Peepers do not rely on biological organisms
- Can be deployed in a variety of sediment types at various depths and in surface water
- Relatively simple to construct, deploy, and retrieve
- Minimal risk of the peeper reflecting surface water concentrations
- Analysis using standard EPA SW-846 methods
- Minimal data processing

BEST SUITED FOR

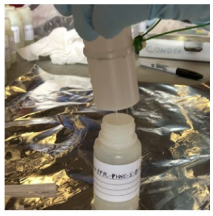
- Metal-contaminated sediments
- Freshwater and marine sediment
- Diver-less deployment for water depth up to 30 feet
- Sediment porewater sampling up to 30 cm depth, 5 cm resolution morphology, composition, and degradation

LITERATURE REVIEW: 45+ YEARS OF RESEARCH

A literature review conducted early in this project provides a comprehensive summary of over 85 peer-reviewed and grey literature documents over the last 45 years on the applications of peepers to measure freely-dissolved inorganics in sediment porewater. The review identified several key technical aspects where additional work would be beneficial to promote the routine application of peepers to aid in regulatory-driven decision making at contaminated sediment sites:

1. Sorption of metals to peeper during deployment and retrieval;
2. Peeper chamber volume and design factor for optimum deployment time and analytical volume;
3. Effect of oxygen contamination on redox sensitive compounds during all stages of peeper preparation and use;
4. Pre-equilibration sampling and use of reverse tracer to calculate true porewater concentrations; and
5. Peeper salinity and the impact of density gradient differences between peeper water and sediment porewater.

Laboratory tests are underway to address these critical issues. These tests aim to demonstrate the most efficient and effective techniques for peeper applications so that approach can be standardized.



LABORATORY EXPERIMENT RESULTS

Ongoing laboratory experiments so far have focused on refining a simple and inexpensive peeper device that provides sufficient volume for commercial laboratories to conduct standard metal analysis via EPA SW-846 methods.

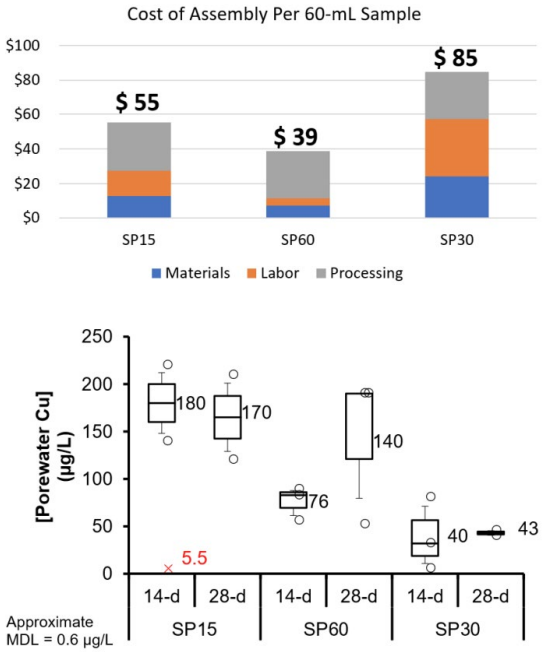


Figure 1: Example copper results shown above indicate that the SP15 peeper design provides an optimal balance in cost, sample volume, and equilibration speed (~14 days)

Additional Resources

Project Webpage

Join this Linked-In group for all the latest updates!

Contact Information: Peeper@Geosyntec.com

About SERDP and ESTCP

The Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP) are the Department of Defense's environmental, resilience, and installation energy and water research programs, harnessing the latest science and technology to improve DoD's environmental performance, reduce costs, and enhance and sustain mission capabilities.