

Capping Media Test Methods

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WEDA Midwest Conference

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Agenda

- Background and History on Sediment Capping
- Active Media
- Test Methods for Active Media
- Treatability studies: In-situ Solidification/Stabilization (ISS)

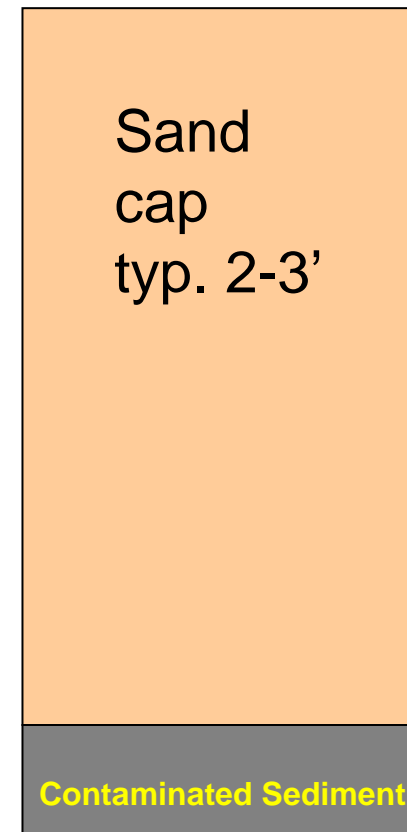
Dredging and Capping

- Types
 - Dredge and cap same area. Typically, in river want to maintain volume for flood control.
 - Dredge some areas and cap other areas.
- Capping delivery methods:
 - Bulk (sometimes w/ sand)
 - Pelletized w/ substrate
 - Geotextile mat
 - Lined gabion



Passive Sand Caps

- Can be effective for highly immobile contaminants, such as PCBs and metals.
- Not effective w/ DNAPL.
- May require a thick layer to be effective due to low organic content (1-5%).
- Test sand for contaminants (USEPA Sw-846 methods 8260/8270) and TOC (USEPA SW-846 method 9060).



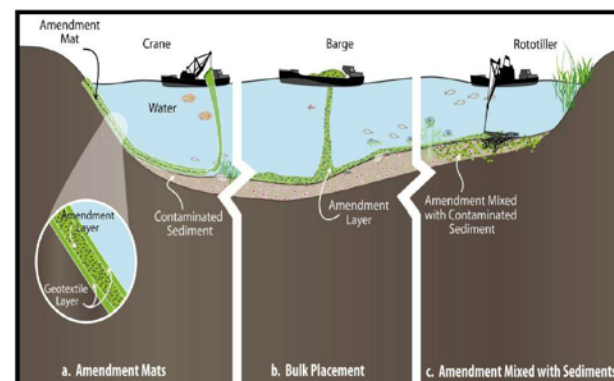
Active Caps

- For decades active media have been successfully used to treat contaminated water and groundwater. But only recently have they been adopted to contaminated sediment.
- The appropriate use of these amendments has the potential to limit exposure to contaminants and, thus, to reduce risks.



Office of Superfund Remediation and
Technology Innovation

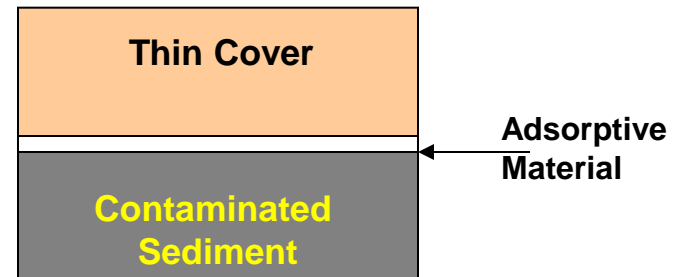
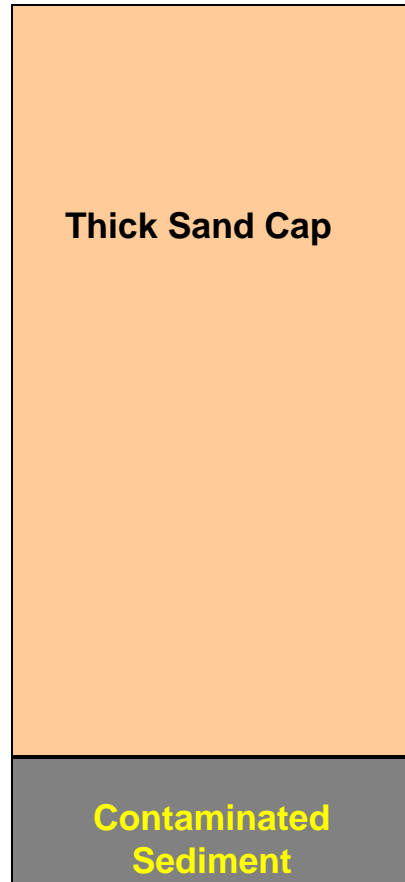
Use of Amendments for In Situ Remediation at Superfund Sediment Sites



OSWER Directive 9200.2-128FS

April 2013

Sand Cap versus Active Cap



Midwest Projects

- Stryker Bay section of Saint Louis River Interlake Duluth Tar (SLRIDT) site.
- Former pig iron, coking plant and coal gasification plant.
- West side was dredged.
- East side was capped with AC mat & sand due to high naphthalene concentrations.
- Monitoring for five-year review in 2013 showed that cap was performing as expected.



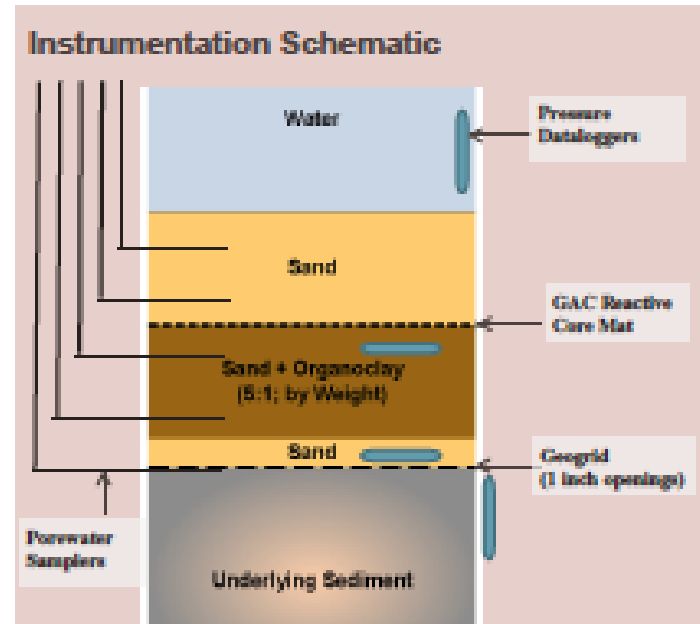
Midwest Projects

- Grand Calumet River site
– divided into east and west branches and reaches.
- Various capping materials used:
 - AC mat
 - Bulk organophilic clay & sand
 - Organophilic clay Aquagate™.



Active Media Types

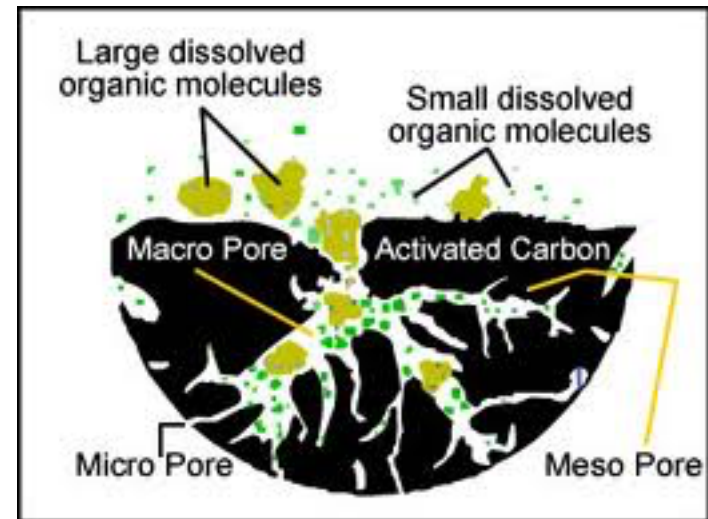
- Activated carbon
 - Adsorbs dissolved organics (PAHs, PCBs, dioxin, pesticides) and some metals.
- Organophilic clay
 - Sorbs dense non-aqueous phase liquids (DNAPLs), such as coal tar and creosote.
- Other – apatite (Pb), siderite (pH).



By Sean Carroll, Haley & Adrich

What is Activated Carbon?

- Activated carbon, made by the heating and activation of different raw materials (e.g., coal, coconut shells), is highly porous.
- Activated carbon has entrained air that can cause it to float. This buoyancy can be offset several ways; wetting, compressing w/ other materials, or placing in a mat.



What is Organophilic Clay?

- Organophilic clay is a base clay (typically sodium bentonite) that undergoes an ion exchange process with a quaternary amine or polymer.
- Changes properties from hydrophilic to organophilic.
- For sediment capping it is either in a granular form or compressed onto gravel.



Index test vs Performance test

- Performance test measures directly a property that is part of design (e.g., settling rate).
- Index test measures a property that is related to the design property (e.g., particle size, specific gravity).
- Performance tests can be costly or time consuming. So index tests are useful in minimizing costs and turnaround in quality control.

Test Methods – Activated Carbon

- ASTM D2854 – Apparent Density. Tapped cylinder.
- ASTM D2862 – Particle Size Distribution. Sieve analysis. Sieves conforming to E11.
- ASTM D2866 – Total Ash Content. Muffle furnace @ 650 °C for 3 hours.
- ASTM D4607 – Determination of Iodine Number. Relative activation level by adsorption of iodine from aqueous solution.
- Batch adsorption test. Tumbled amber jars w/ aqueous solutions and zero airspace.



Committee
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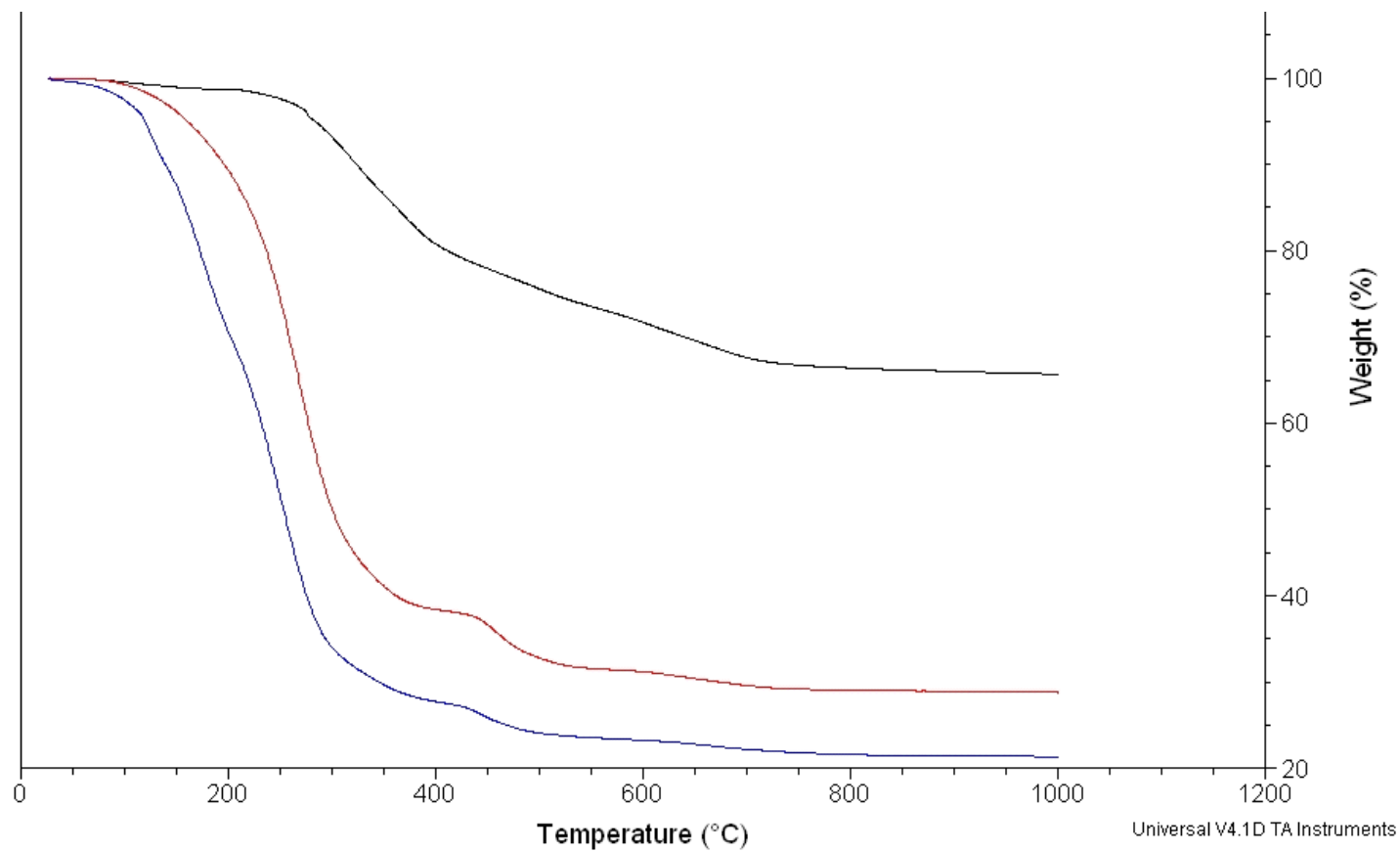


Test Methods – Organophilic Clay

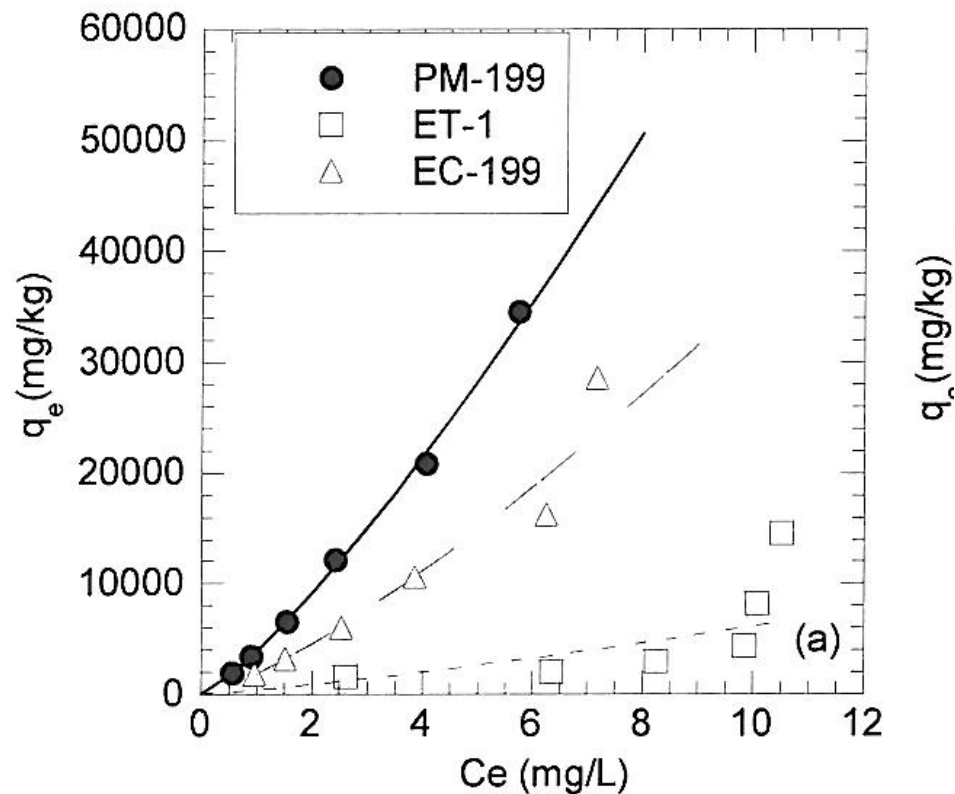
- ASTM D7626 – Treat Loading. Muffle furnace @ 750 °C or Thermal Gravimetric Analyzer (TGA).
- WK 53109. Oil Sorption Capacity. Index test w/ SAE W₃₀ SA grade motor oil.
- ASTM 7481, Method A – Bulk Density. Shaken graduated cylinder.
- ASTM C136 or D422 - Particle Size Distribution. Sieve analysis.
- Batch adsorption test. Tumbled amber jars w/ aqueous solutions and zero air space.



TGA print out



Naphthalene adsorption for 3 organophilic clays (Benson 2008)



Settling Column

- Can run settling test on any media.
- Clear acrylic w/ drain.
- US Army Corps of Engineers Vicksburg settling column is minimum 8" diameter to minimize any edge effects.



Hydraulic conductivity tests

- Test depends upon expected permeability
 - Low permeability (ASTM D5084, D7100)
 - High permeability – granular media (ASTM D2434)
 - High permeability – geotextile (ASTM D4491)



Amendments for Sediment Remediation

Characterizing the media using test methods is critical for:

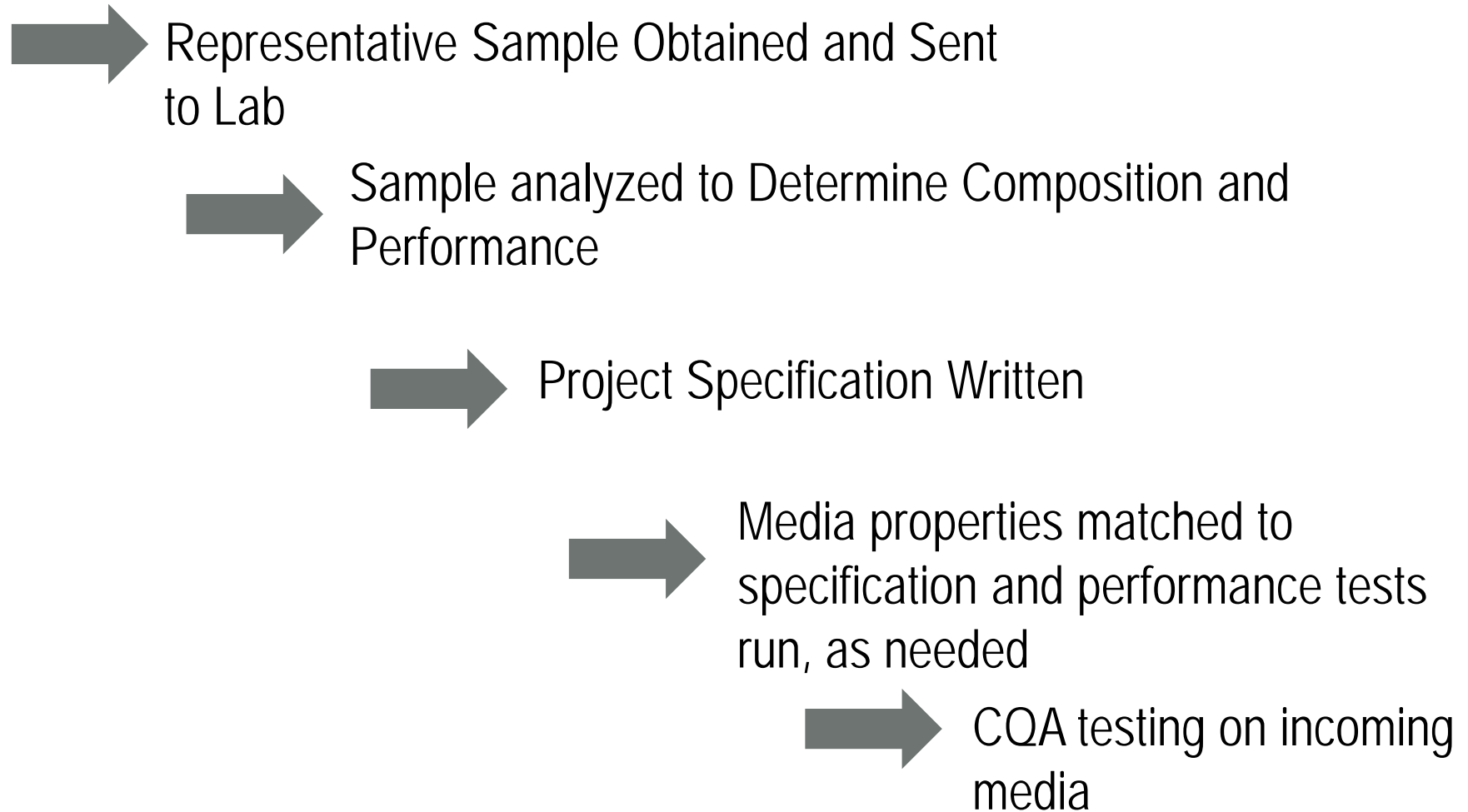
- Design Testing
- Specification Writing
- Construction Quality Control Testing



Amendments for Sediment Remediation

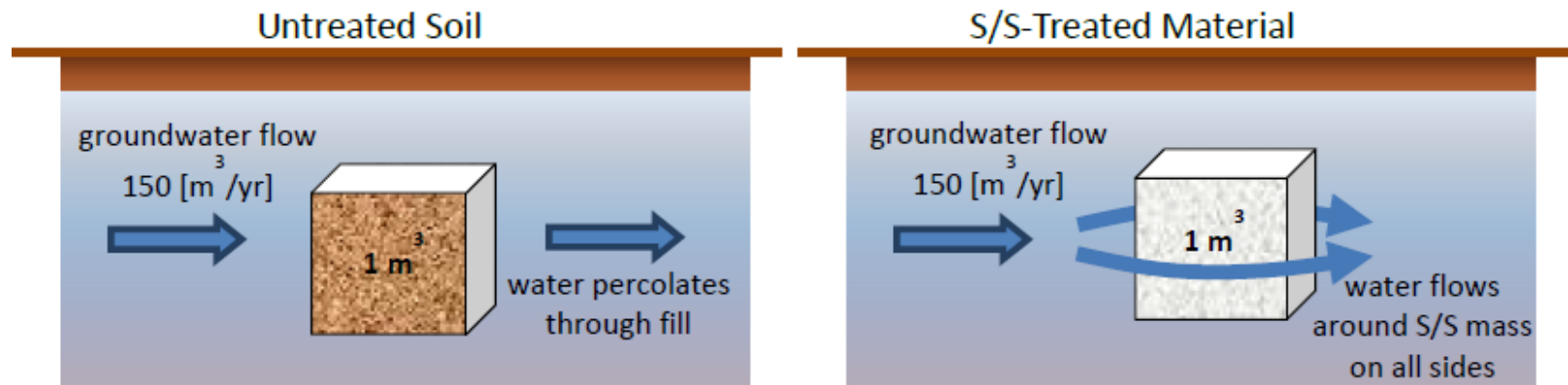
- Activated carbon
 - Evaluate various types (coal, coconut) and suppliers.
 - Dissolved organic compound batch sorption testing.
- Organophilic clay testing
 - NAPL sorption capacity (ASTM standard work item).
 - Dissolved organic compound batch sorption testing.
 - Treat loading (ASTM D7626).
 - Settling velocity.

Active Media Testing Process



In-situ Solidification & Stabilization

- ISS typically mixes Portland cement (or fly ash) and other additives into soil or sediment.
- ISS goal is to achieve acceptable concentrations at a point of compliance by reducing the hydraulic conductivity and chemical leaching from treated soil or sediment.
- Bench scale treatability study determines mix options that achieve the project goals.



Thanks for your time.

QUESTIONS?