# Groundwater and Surface Water Fingerprinting of PCB Data at GE site

Spokane River Regional Toxics Task Force
September 28, 2022 Meeting

Background

- GE has a Superfund NPL site located between Upriver Dam and Greene St.
- EPA developed a scope of work to determine whether Spokane River data indicate a release of PCBs from the GE Site
  - EPA contractor had a conflict of interest
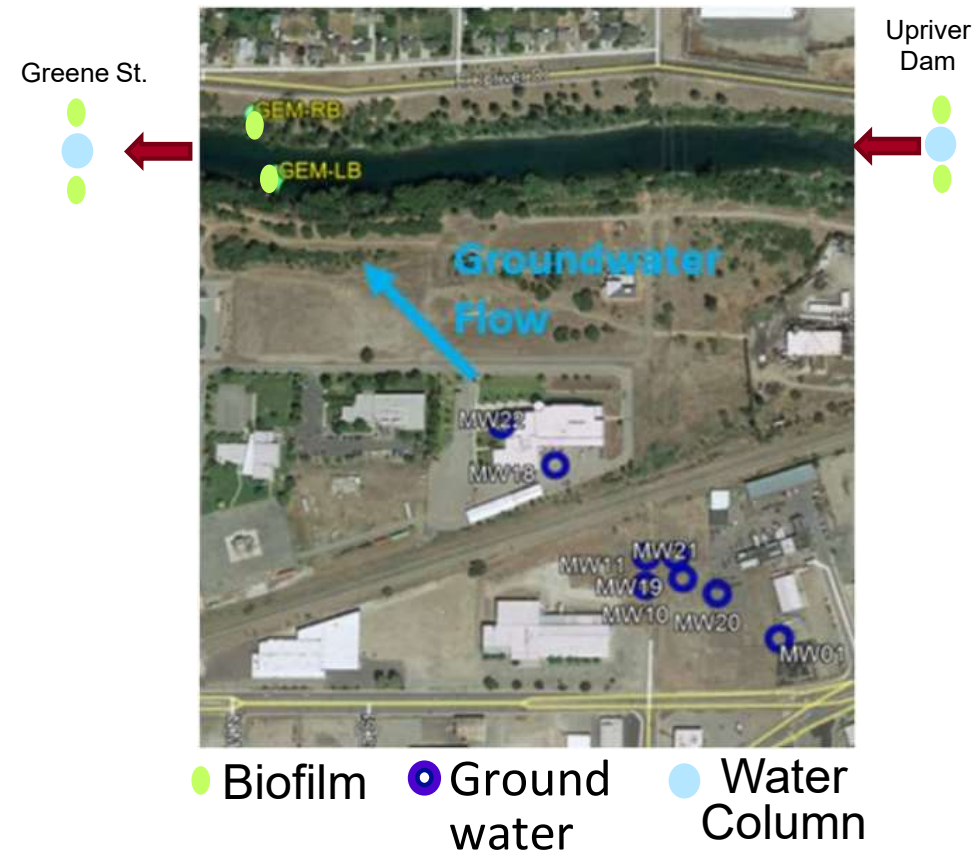 - Task Force may be interested in conducting the work
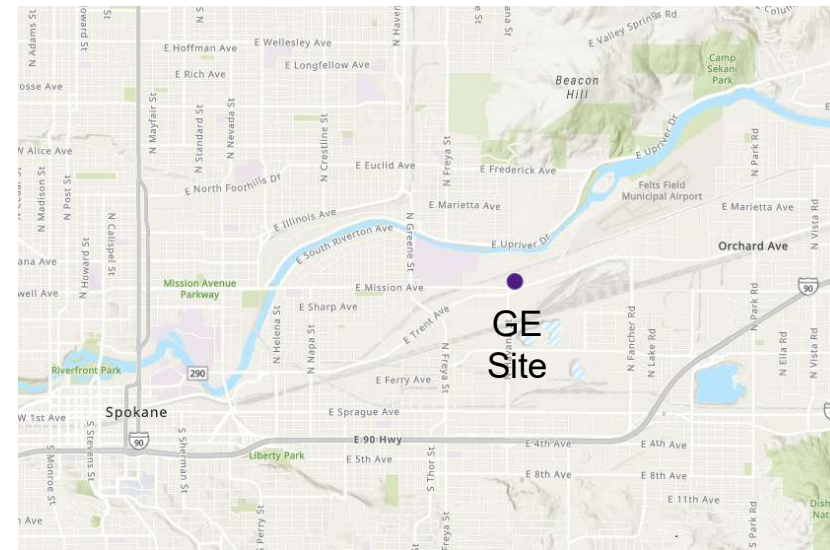
Available Data from Site

- Groundwater
  - Multiple wells between GE site and river
- Biofilm
  - Immediately downstream: left and right bank
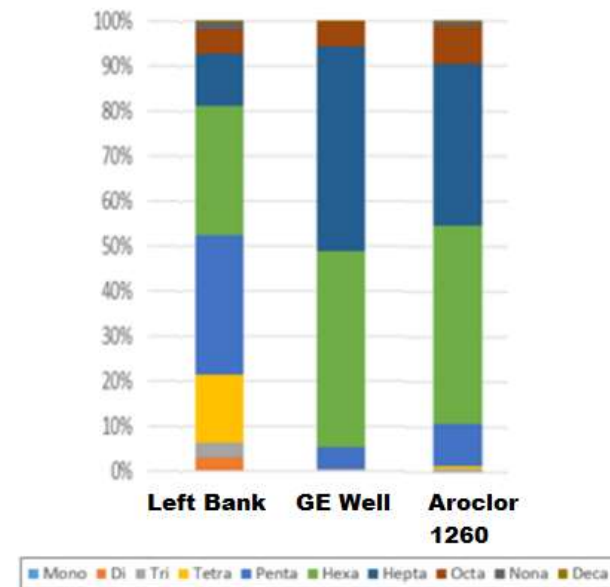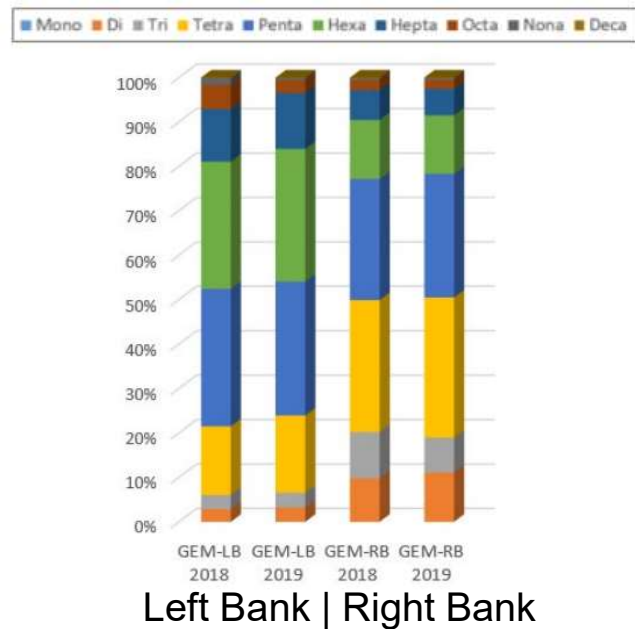

● Biofilm ◉ Groundwater

Other Available Data

- Biofilm
  - Far upstream and downstream
- Water column
  - Far upstream and downstream: mid-channel

Biofilm   Ground water   Water Column

Homolog Distributions Analyzed by Ecology

- GE left bank appears different than right bank

- GE left bank is different than GE well
- GE well appears similar to Aroclor 1260

Left Bank | Right Bank

Task Order Issued by EPA

- Determine whether Spokane River water and biofilm data indicate a release of PCBs from the GE Site

- Component steps

  - Perform mass balance on PCB congeners in water upstream and downstream of GE

  - Analyze congener patterns in river data and compare to congener data in groundwater wells

Perform Mass Balance on PCB Congeners in Water Upstream and Downstream of GE

- Similar to mass balances conducted in the past at a homolog level
  - Calculate mass of PCBs at upstream and downstream end of a river reach
  - Assign any calculated difference to "unmonitored" load
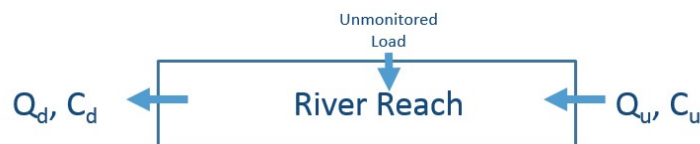
2018 Homolog Mass Balance Results
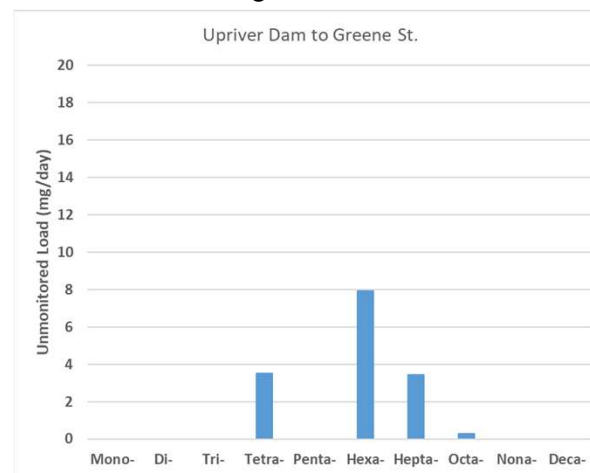
Compare Water Column And Biofilm Data To Congener Data in Groundwater Wells

- Two levels of options
    - Cosine theta sample similarity analysis
    - Polytopic vector analysis (fingerprinting)
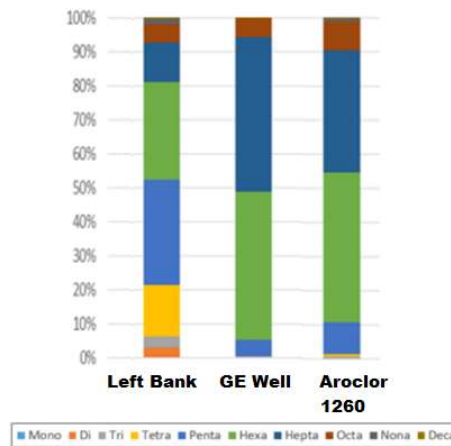- Different levels of effort, different benefits

Cosine Similarity Assessment

- Method for assessing similarity in patterns between two samples
- Generates a parameter (Cos-θ) similar to a correlation coefficient
    - Ranges from 0 to 1
    - Examples
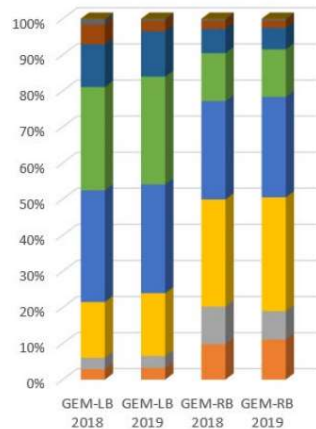
Similarity between left bank and right bank = 0.52

Left Bank | Right Bank

Similarity between left bank and GE Well= 0.71

Similarity between GE Well and Aroclor 1260= 0.91

What Do We Get from Cosine Similarity Assessment?

- Can assess similarity between the congener pattern in biofilm and different assumptions regarding the presence of GE groundwater

  - e.g., "a mixture of 45% upstream and 55% GE groundwater provides the highest similarity to biofilm at GE Left Bank
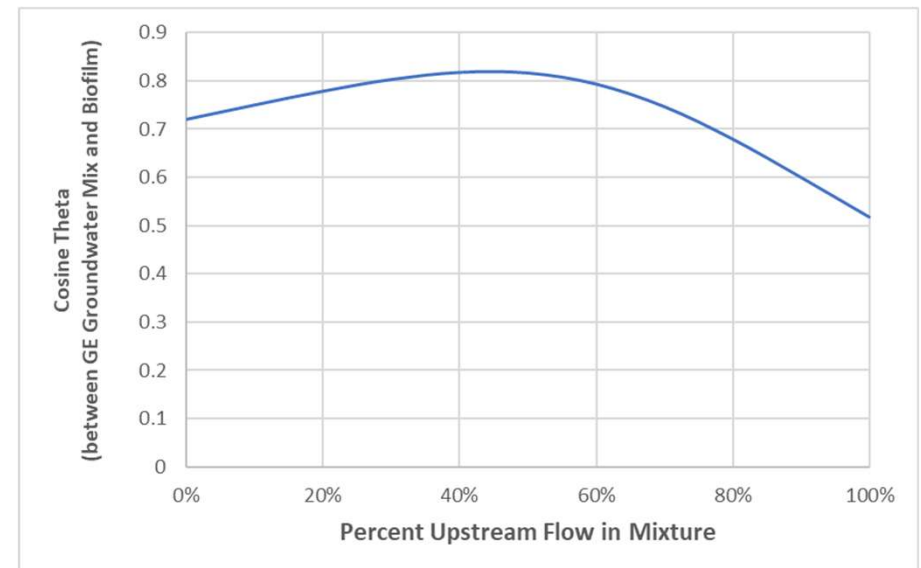
Fingerprinting Option

- Method is called Polytopic Vector Analysis (PVA)
  - Same concept as positive matrix factorization (PMF) conducted by Dr. Rodenburg
- "Un-mixes" environmental samples into the original source contributions

What More Do We Get from Fingerprinting?

- Potential identification of a signal related to GE groundwater

- More quantitative (and less uncertain) assessment of presence of this signal at GE site and downstream stations

  – Cosine theta analysis assesses pattern similarity resulting from different assumptions

  – Fingerprinting provides explicit answers to questions:

    - "Do we see a GE signal in Spokane River biofilm?"
    - What percentage of the biofilm PCB is attributable to GE?

- Allows for consideration of broader set of sources and processes

Costs for Various Options

- Congener Mass Balance plus Cosine Theta
  - $25,000
  - Consistent with EPA-specified level of effort of 178 hours
- Congener Mass Balance plus Fingerprinting
  - $45,000

TTWG Recommendation

- Prepare a formal scope of work for Congener Mass Balance plus Fingerprinting for Task Force approval
  - $45k budget
- Request for Task Force to approve project in concept today
  - Formal scope will be available for review one week prior to October SRRTTF Meeting
  - Formal vote to approve scope and budget as part of biennial work plan at October SRRTTF meeting