Mercury Speciation via Diffusive Gradients Thin-films Technology

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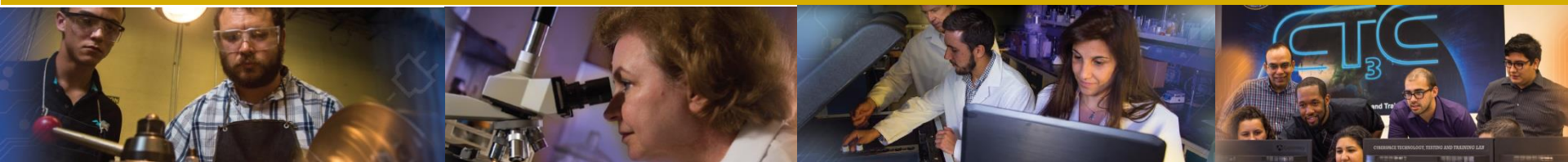
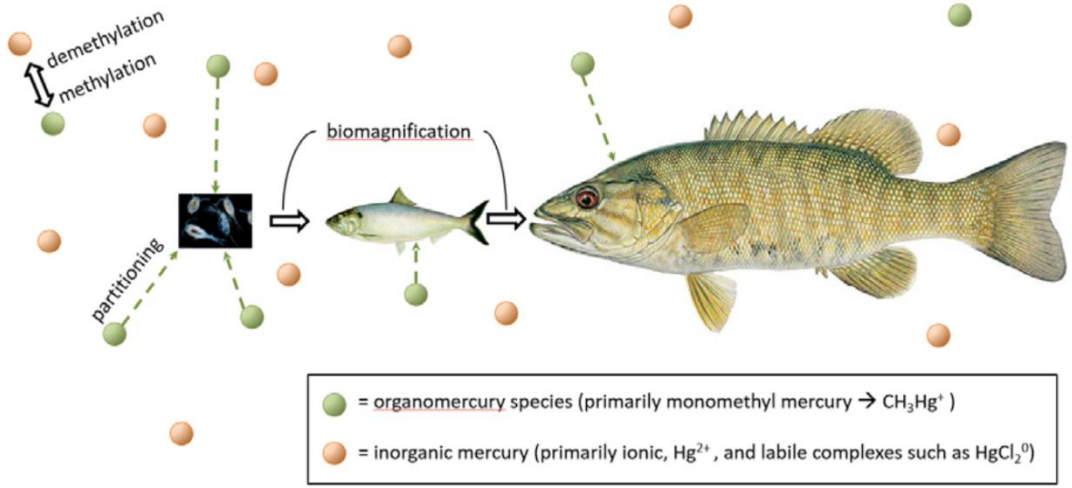


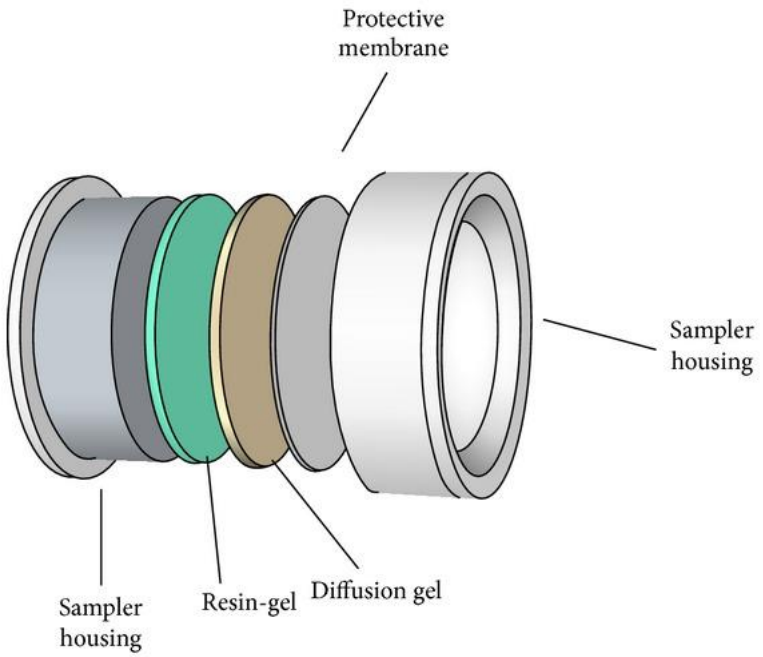
Project Description/Background

- Mercury is a crucial and persistent environmental pollutant that is bioaccumulative.
- It exists in different forms including elemental mercury, inorganic mercury, and methylmercury.
- Methylmercury is a toxic organic compound. Mercury, particularly methylmercury, accumulates in biota such as fish resulting in potential human health impacts.
- DGTs are innovative samplers to measure water concentration by diffusion and capture.
- Types of Hg DGTs used: Total Hg, Inorganic Hg, & Methyl Hg.



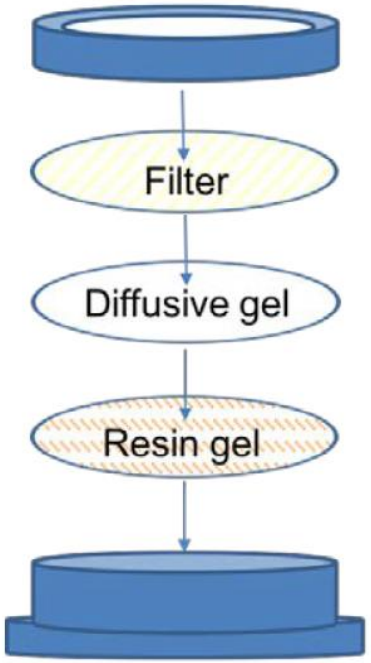
Scope/Objective

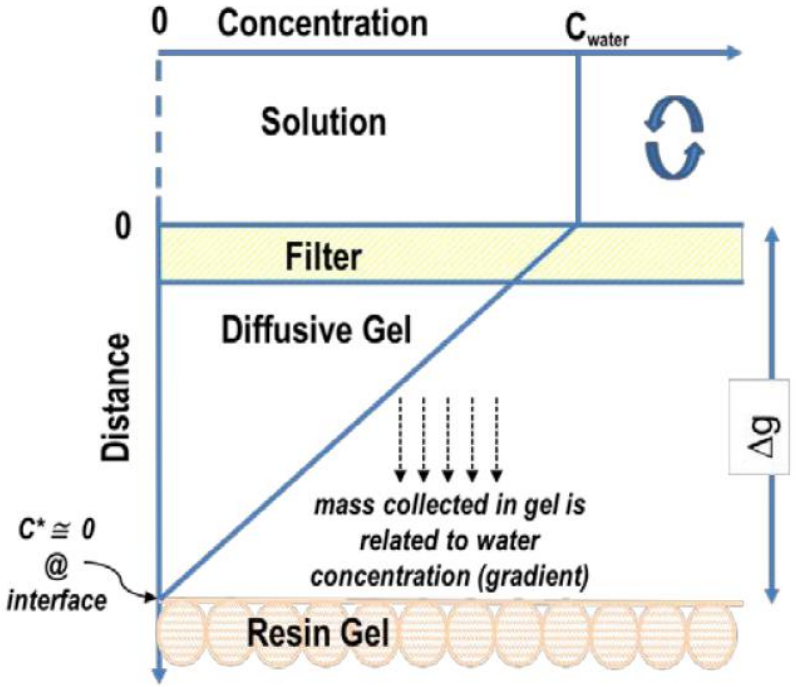
- Develop and test various diffusive gradient in thin films (DGT) samplers for mercury – SRNL is developing reactive DGTS (rDGTs).
- Test chemistry to differentiate methylmercury from total and/or inorganic mercury in environmental samples.
- Fabricate and test rDGT samplers for deployment.
- Deploy the rDGTs in variable settings.



What is a DGT?

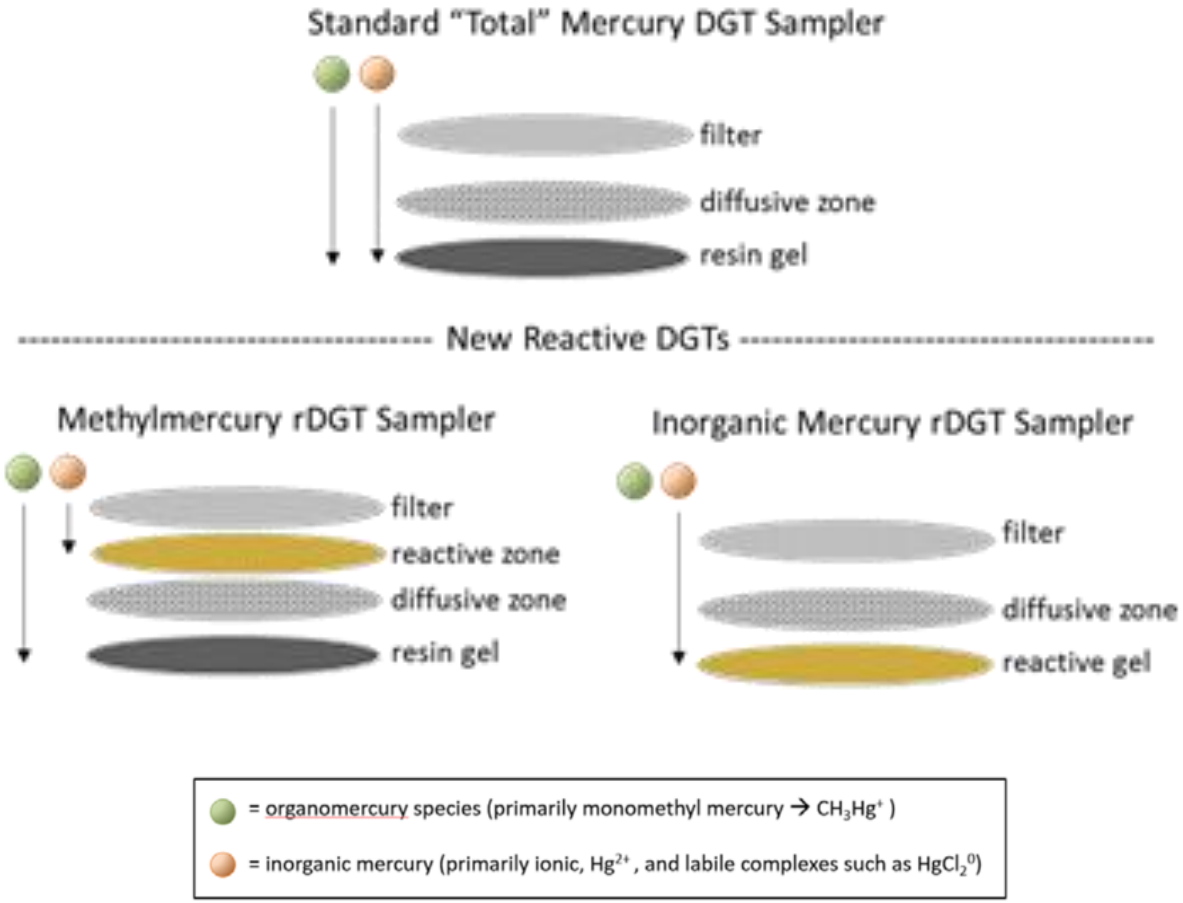
$$C_{DGT} = \frac{M\Delta g}{DtA}$$



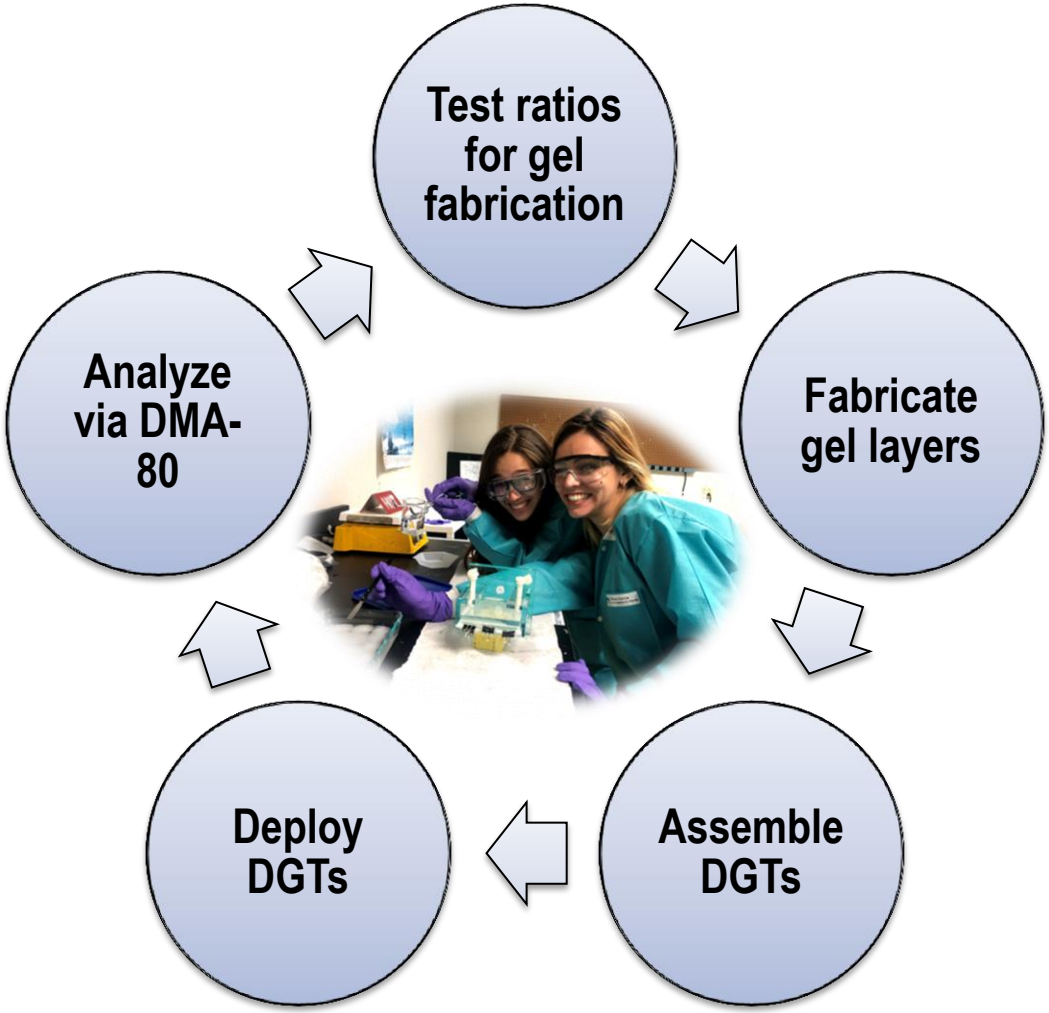


$$2Cu(O) + Hg^{2+} \rightleftharpoons Cu^{2+} + HgCu(am)$$

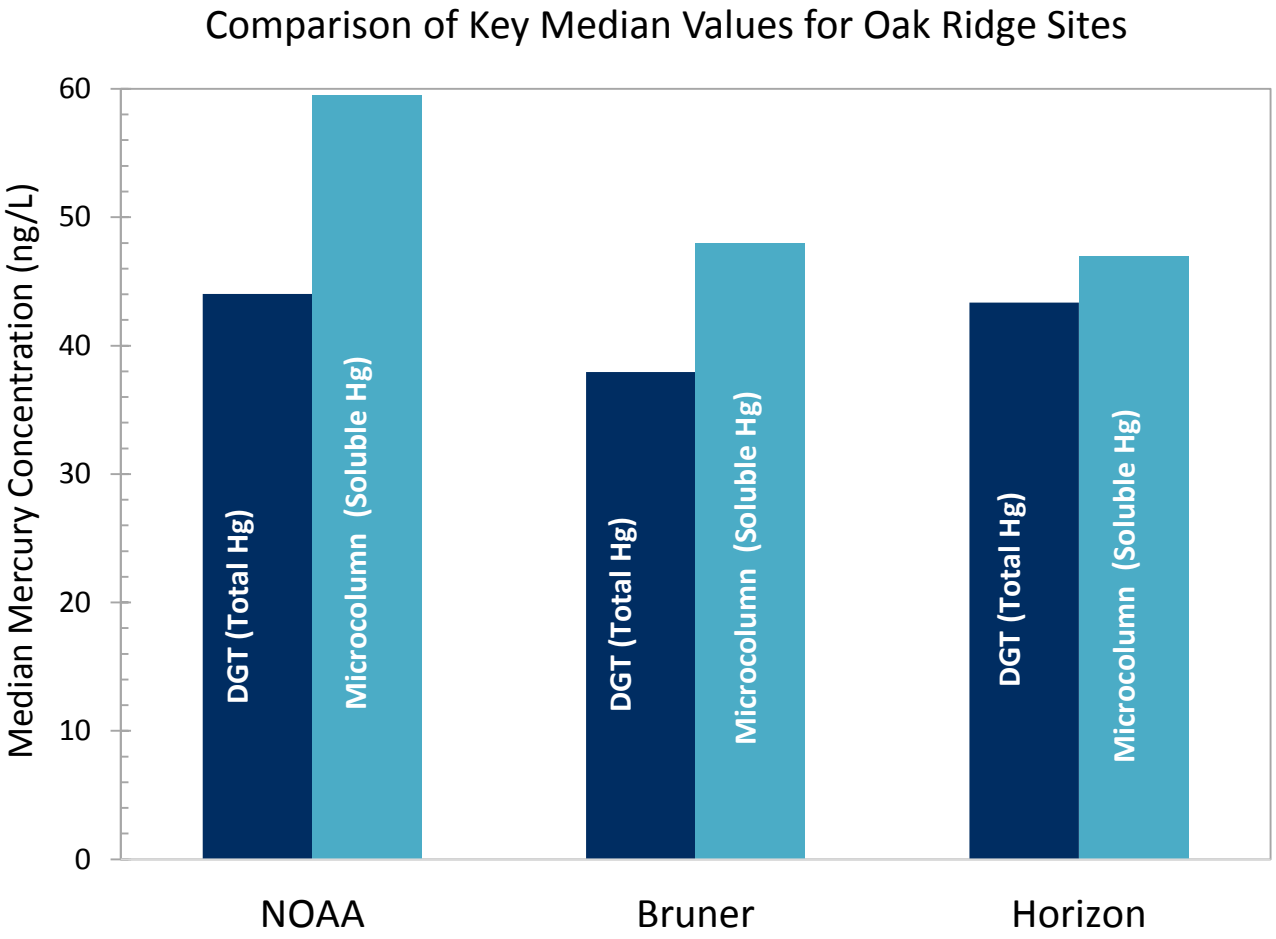
Creating a rDGT for Hg Speciation



Method/Approach



Preliminary Results/Discussion

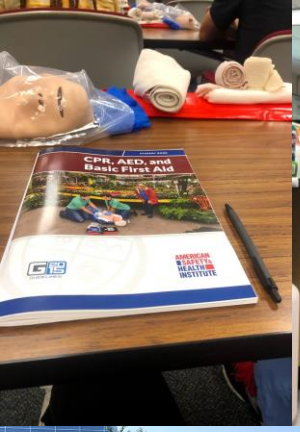


Conclusions

- DGT concentration estimates (dark blue) closely matched alternative measurements (light blue) for soluble mercury at each Oak Ridge site.
- DGTs provide a representative measure for biota uptake since they are left out longer which allows for an average exposure concentration.
- DMA-80 provided an efficient and quick analysis.
- Variability in site location made a difference in Hg species.
- Copper reagent degraded agarose gel – more work and cleaner data are needed to assess speciation in rDGTs.
- The data didn't validate the speciation because the diffusive layer and the collection layer collapsed.

Future Work

- Use cross-linked polyacrylamide for the collection layer for a stronger plastic.
- Make a copper diffusion layer without agarose or separate them using filters
- Test copper separation in lab using realistic stream conditions such as high organic carbon.
- Future studies on diffusive coefficients.
- Examine DGTs with thinner diffusive zones for shorter deployment time.


CPR, AED, and
Basic First Aid





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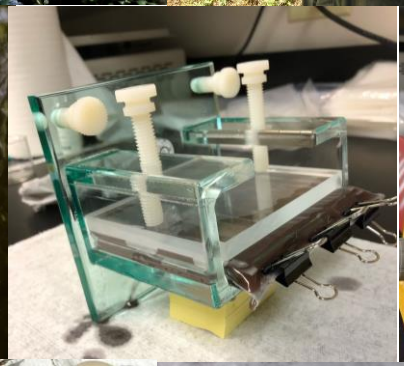





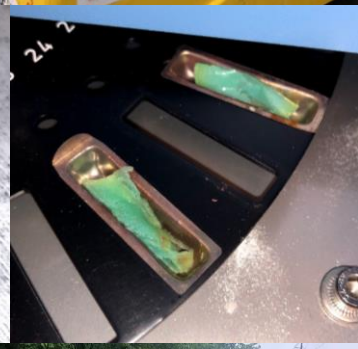





CAUTION
SOIL
CONTAMINATION
AREA

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