

Benthic Flux Chamber Methods Development Update

October 11, 2007

Outline of Discussion

- Background
- Results To Date
- Path Forward

BFC Program Objective

- Direct measurement of flux of THg, MeHg, Mn, and Fe from the dominant South River substrates so that their relative contributions of Hg to the surface water can be determined.

BFC Methods Development Efforts To Date:

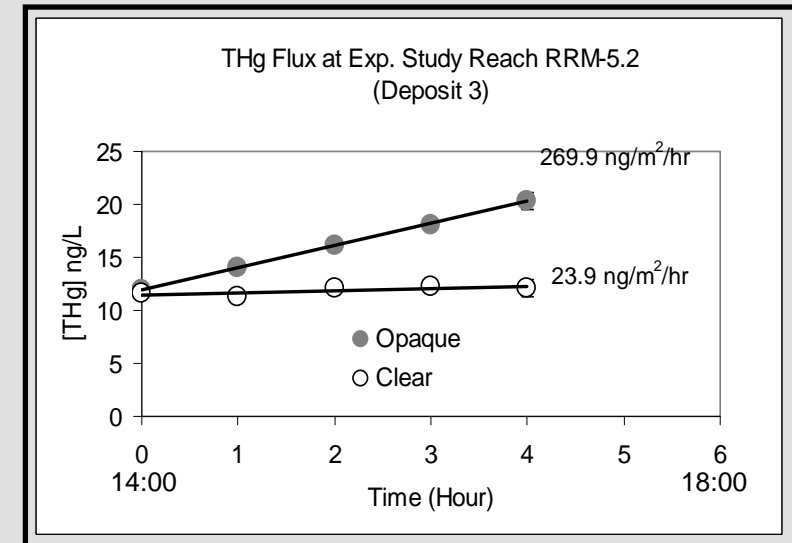
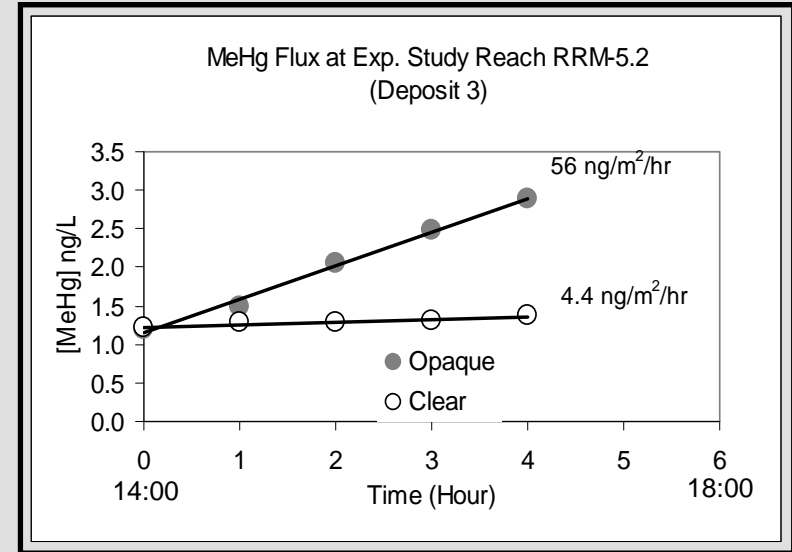
- FGCM Deposits (Mud) Study
 - Five locations were studied
 - SR-01, RRM-2.0, RRM-3.0, RRM-5.2, and RRM-13.1
- Rock Plate Study
 - Five locations were studied
 - SR-01, RRM-2.0, RRM-3.0, RRM-5.2, and RRM-13.1
- Embedded Gravel Study
 - Methods are being developed

Fine Grain Channel Margin (Mud) Study



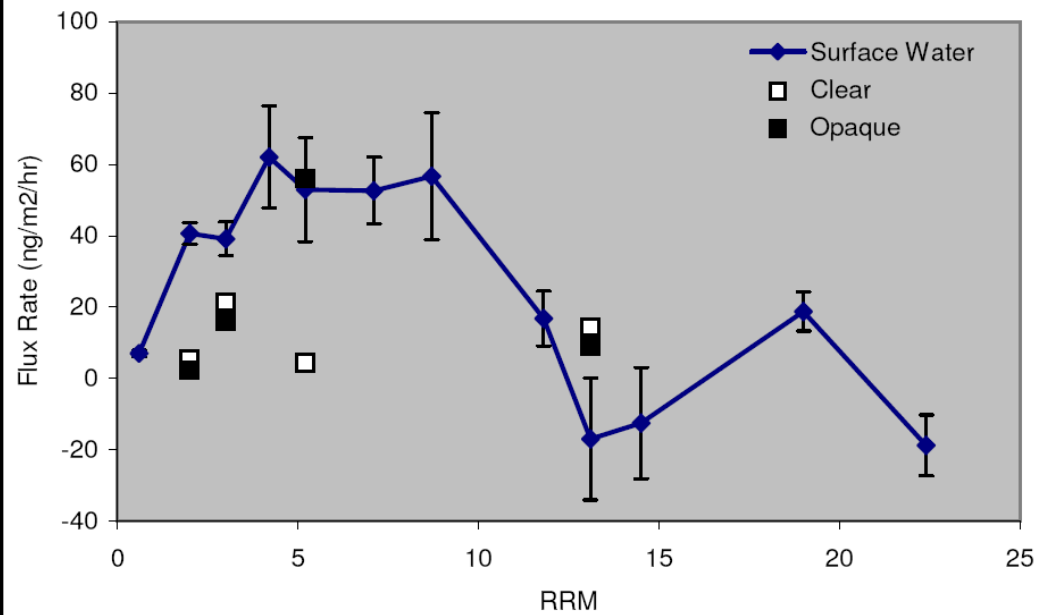
Data trends

- Data tends to be well behaved
- As DO drops Mn & Fe flux generally increase
- As Mn & Fe flux increase, MeHg & THg flux generally increase
- MeHg varied by a factor of 10 & THg by 100
- Dissolution of minerals during diurnal cycling may account for some of the THg & MeHg
- The BFC methods development for the FGCM deposits appears to be complete.

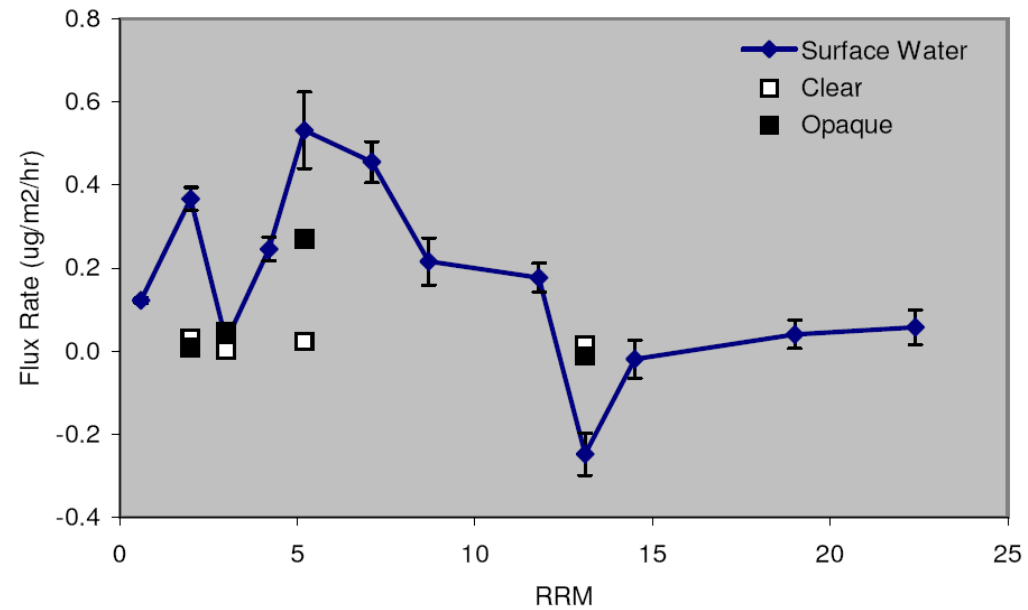


"Reality Check": BFC Flux Vs SR Flux

June 2006 MeHg Flux Rate Comparison: FGCM Deposits vs. Predicted Fluxes from Surface Water



June 2006 THg Flux Rate Comparison: FGCM Deposits vs. Predicted Fluxes from Surface Water

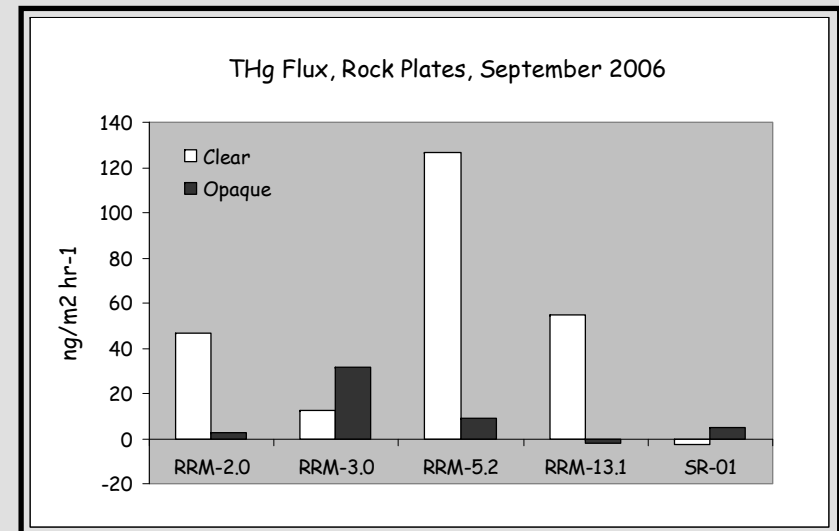
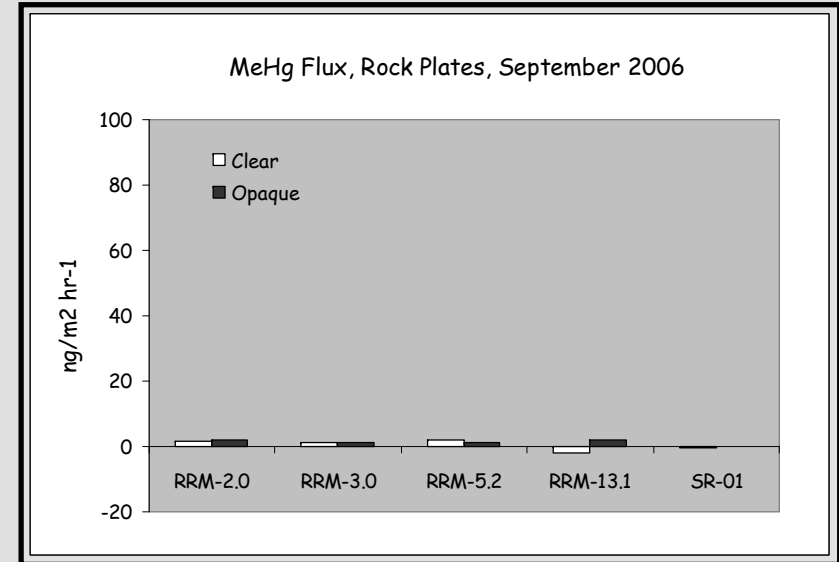


Rock Plate Study



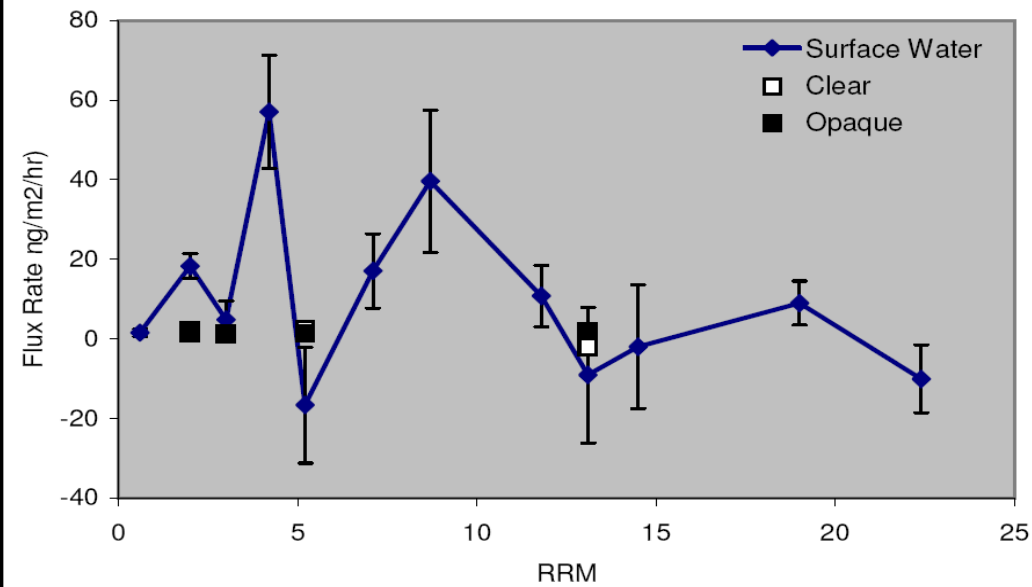
Data trends

- Data tends to be well behaved (THg?)
- DO was increasing in the Clear BFCs and relatively steady in the Dark BFCs
- Dissolution of Fe & Mn was not observed
- MeHg varied by a factor of 2 & THg by 100
- The rock plates appear to effectively simulate the streambed (sediment & flora)
- The BFC methods development for the rock plates appears to be complete

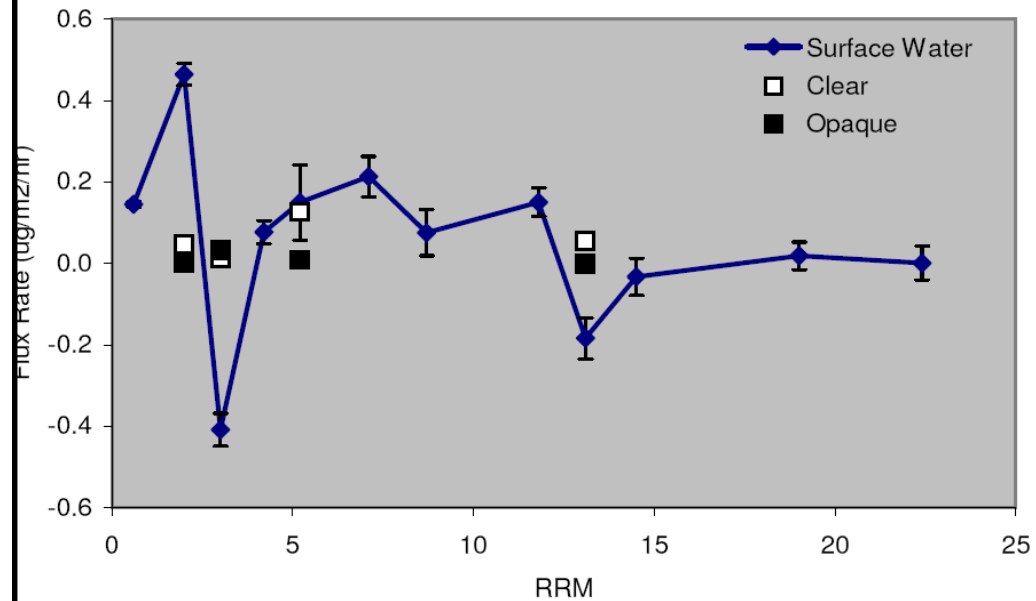


"Reality Check": Rock Plate Flux Vs SR Flux

September 2006 MeHg Flux Rate Comparison: Rock Plates vs. Predicted Fluxes from Surface Water



September 2006 THg Flux Rate Comparison: Rock Plates vs. Predicted Fluxes from Surface Water



Embedded Gravel Study

- Hyporheic flow
- The plates were anchored and grouted to the streambed
- Rock Plate type BFCs were attached to the plate
- A chloride tracer was injected into the BFC
- Conductivity was measured using a YSI 556 conductivity probe, a YSI 556 flow through cell, and a peristaltic pump
- The tracer was monitored over time to check the integrity of the grouted seal

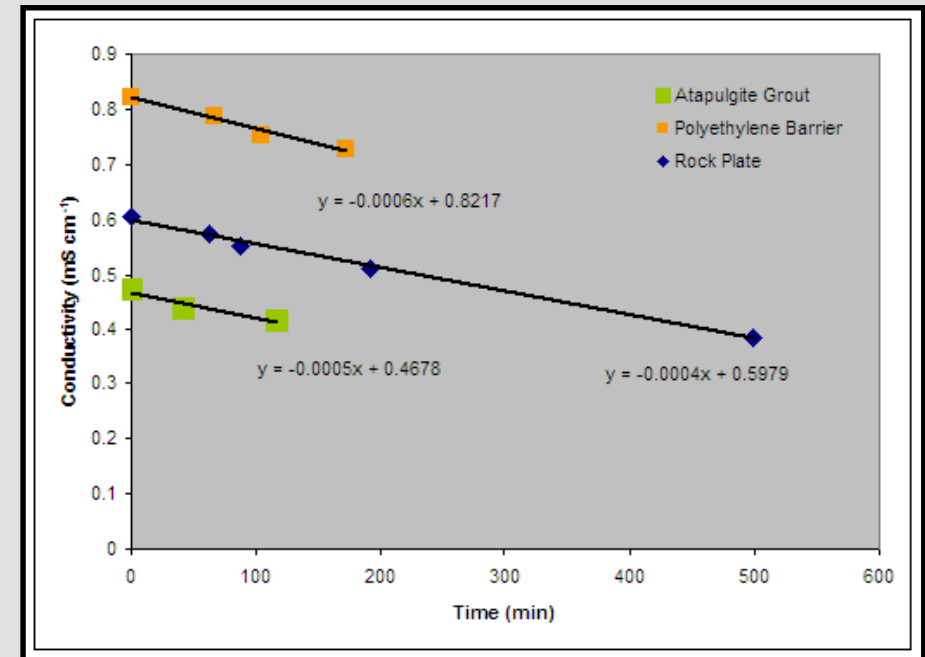
Embedded Gravel Study



Data trends:

- Chloride data was well behaved
- The attapulgite grout appears to effectively seal the plate to the streambed
- The grout materials needs to be tested for Hg adsorption / desorption - Dr Gill
- Method development for the embedded gravel plate is on-going

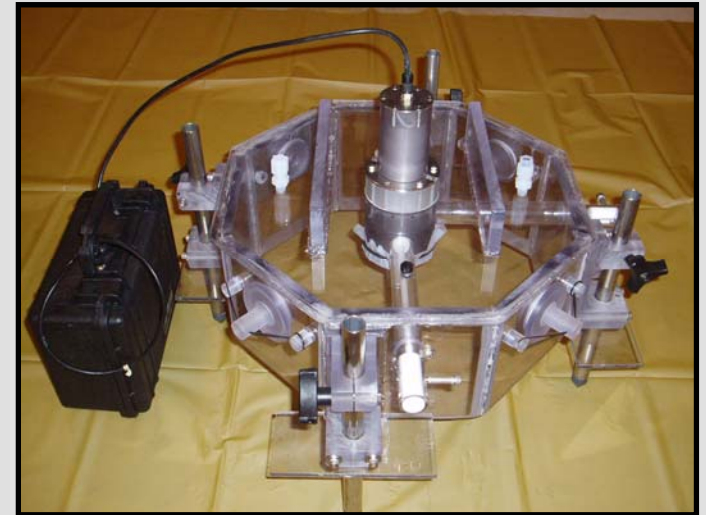
Chloride Tracer Results



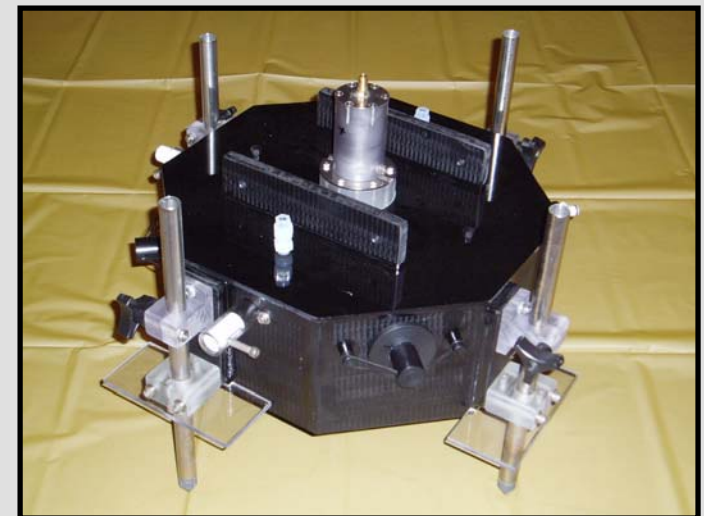
BFC Study Summary

- BFCs are able to measure low level flux from the various SR substrates
- Data tends to be well behaved
- Opaque BFCs can effectively shutdown photosynthetic DO production processes.
- Diurnal effects and dissolution of mineral phases (Fe & Mn) may account for some of the THg and MeHg in surface water
- The rock plates appear to effectively simulate the streambed
- MeHg flux from the rock plates varied by a factor of 2 & THg by 100
- MeHg flux from the FGCM deposits varied by a factor of 10 & THg by 100

Transparent BFC



Opaque BFC



South River BFC Efforts - Path Forward

What?

- FGCM (mud), Embedded Gravel, & Wetlands will be studied:
- Study will be keyed with the Phase I - Year II Eco Study areas

When?

- Sampling will be done 3 to 4 times next year
- Sampling will be done during the same time frame

How?

- Transparent and opaque BFCs will be deployed
- The FCGM and embedded gravel study, but the wetland study may be separated

Benthic Flux Chamber Update

Questions ?