ABSTRACT TITLE: Storm dynamics of Hg and MeHg in East Fork Poplar Creek: What can it tell us about transport and source areas of Hg and MeHg within the catchment?

ABSTRACT: East Fork Poplar Creek (EFPC) in Oak Ridge, TN currently receives a steady supply of inorganic Hg (~50-150 ng/L) from its headwaters due to historic contamination. Stream sediment and adjacent floodplain soils downstream have a wide range of elevated levels of Hg (5-40 mg/kg dw) and methylmercury (MeHg) (1-30 µg/kg dw). It is unclear if floodplain MeHg is a dominant contributor to the creek, which has steadily increasing concentrations of MeHg downstream. We investigate the variability in stream Hg and MeHg with changes in discharge and corresponding hydrologic connectivity between the creek and surrounding floodplains to elucidate origins of watershed Hg and MeHg contributions downstream and factors that affect mobilization.

From March 2012 through March 2013 four high-flow events were sampled along rising, peak and falling limbs of each storm hydrograph in Spring, Summer, Fall and Winter seasons. Monthly baseflow samples were also taken. The range of discharge conditions sampled (n=124 to date) is approximately 20 cfs (summer baseflow) to 4100 cfs. Samples were analyzed for filtered and unfiltered Hg and MeHg, dissolved organic carbon (DOC), UV-vis spectra, anions, metals and total suspended solids (TSS). During all storms particulate Hg and MeHg concentrations increase directly with TSS, approximately 12 ng Hg and 0.013 ng MeHg per mg TSS ($r^2=0.92$ and 0.78, respectively). Similar to most non-industrially contaminated systems, dissolved Hg (HgD) increases in synch with DOC concentration for all events ($r^2=0.71$). These results suggest that DOC is an important transporter of watershed Hg even with the high Hg/DOC ratio at our site (~ 7 ng Hg per mg DOC as compared to 0.2-0.7 ng Hg per mg DOC reported for systems receiving Hg primarily from atmospheric deposition). Unlike HgD, dissolved MeHg (MeHgD) dynamics were not consistent for all events, decreasing in concentration during the two larger events and remaining stable for the smaller storms revealing floodplain soil water mobilized during storms is not a transport mechanism that increases in-stream MeHgD concentrations. Future analysis will evaluate both storm specific and seasonal MeHg and Hg patterns in relation to all other water quality parameters as well as discharge.