Storm Dynamics of Hg and MeHg in an Industrially Contaminated Creek: What Can It Tell Us About Source Areas of Hg and MeHg Within the Catchment?

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Sediments in East Fork Poplar Creek, Oak Ridge, TN as well as floodplain soils in the surrounding watershed, are contaminated with high levels of mercury (Hg) and methylmercury (MeHg). Concentrations of Hg and MeHg in floodplain soils (mean 25.3 and 0.020 ng/mg dw, respectively) are equal to or higher than creek sediment (mean 5.4 and 0.006 ng/mg dw, respectively). Floodplain soils are a potentially significant source of both Hg and MeHg to the stream, however their contributions have not been evaluated. We investigate the variability in stream Hg and MeHg with changes in discharge and corresponding hydrologic connectivity between the creek and surrounding floodplains. Understanding concentration dynamics during high-flow periods will help elucidate the relative importance of floodplains as source areas of in-stream Hg and MeHg. 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 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 increased (up to 150X greater than baseflow) during the rising hydrograph limb and were closely correlated with TSS (r^2=0.92 and 0.78, respectively). The amount of Hg and MeHg per mg sediment in suspended particles (~ 12 and 0.013 ng, respectively) is between that for bed sediment and floodplain soils indicating a mixture of those sources. Similar to the particulate form, dissolved Hg (HgD) concentrations increased during high-flow events, though more moderately (up to 5X greater than baseflow) and offset in time (typically on the peak and falling hydrograph limb) and were associated with an increase in DOC (r^2=0.71). The amount of HgD per mg DOC varied between 3-8 ng for all flow conditions indicating the DOC transported from the watershed during high flow is similar in Hg content to that measured during baseflow conditions. Unlike HgD, dissolved MeHg (MeHgD) concentrations either decreased or remained stable during storm events indicating floodplain soil water mobilized during storms does not increase in-stream MeHgD concentrations.