**Biogeochemistry of mercury in contaminated sediments of East Fork Poplar Creek**

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**Abstract:**

Mercury use at the Oak Ridge Y-12 National Security Complex (Y-12 NSC) between 1950-1963 resulted in contamination of the East Fork Poplar Creek (EFPC) ecosystems. Hg continues to be released into EFPC creek from point sources and diffuse contaminated soil and groundwater sources within the Y-12 NSC and outside the facility boundary. In general, methylmercury (MeHg) concentrations in water and in fish have not declined in response to improvements in water quality and exhibit trends of increasing concentration in some cases. Therefore, our study focuses on identifying ecosystem compartments and/or characteristics that favor the production, as well as degradation, of MeHg in the EFPC. Detailed geochemical characterization of the surface water, interstitial pore water, and creek sediments were performed during quarterly sampling campaigns in 2010 and 2011 at two locations in the EFPC. The two sites in EFPC were located 3.7 km (NOAA) and 20 km (NH) downstream of the headwaters. Vertical profiles of interstitial water collected from fine-grained deposits at the creek margin showed decreases in nitrate, sulfate, and oxidation-reduction potential (ORP) with depth as well as increases in dissolved manganese, iron, and small increases in sulfide. The results indicate the progression of terminal electron accepting processes with depth in the upper 30 cm of these fine grained sediments. Interstitial MeHg concentration also increased with depth in August 2010 suggesting these areas served as a source of MeHg. In contrast, interstitial water collected from the center channel of the creek did not exhibit these redox gradients. The observed constant or decreasing MeHg concentrations with depth suggest that the interstitial water in the fast flowing sections of the creek is rapidly exchanging with the surface water and these sections do not serve as MeHg sources. Total Hg concentration in sediment cores from the creek margin was variable, 0.057-24 mg/kg and 0.02-155 mg/kg, at NH and NOAA respectively. MeHg measured on a subset of these sectioned cores ranged from 1.6-3.1 μg/kg at NH and 0.08-9.5 μg/kg at NOAA. Large intra- and inter-site variability of Hg distribution in these samples is partly attributed to the very heterogeneous sediment texture that ranged from coarse- to fine-grained. Methylation and demethylation potentials are also being examined using intact sediment cores and enriched stable isotopes to quantify zones of net MeHg production.