Spatial and seasonal relationships between surface water total and methylmercury, dissolve organic matter and particulates in East Fork Poplar Creek, Oak Ridge, TN

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East Fork Poplar Creek (EFPC) in Oak Ridge, TN, USA has elevated mercury (Hg) concentrations as a result of historical Hg use at the Y-12 National Security Complex (Y-12 NSC). . The objective of this work is to examine the relationship between mercury, both total mercury (Hg) and methylmercury (MeHg), particulate concentrations and dissolved organic matter (DOM) in surface waters of EFPC. Longitudinal surveys along the lower 20 kilometers of EFPC were conducted quarterly from October 2010 to October 2011 with sampling frequency increasing to monthly beginning in December 2011. Unfiltered or filter-passing (0.2 µm) MeHg and Hg were not correlated with DOC quantity or total suspended solid (TSS). Concentrations of unfiltered and filter-passing Hg decreased downstream but the fraction of filter-passing Hg remained relatively constant (10-20%). Both unfiltered and filter passing MeHg increased downstream and were generally higher in warmer months. Filter-passing MeHg constituted 40-80% of total MeHg. The increase in net MeHg concentration with increasing downstream distance was constant: no specific reach of EFPC was identified in which there was a significant change in the rate increase. Ultrafiltration was conducted on a limited number of samples collected at several locations along EFPC in April and August 2011 and all of the filter-passing (<0.2 µm) MeHg also passed a 3 kDa cutoff filter. DOM quantity, measured as dissolved organic carbons (DOC), and quality, assessed using UV dependent characteristics of the DOM including slope ratio (SR, ratio of slopes of the log transformed absorption coefficients between wavelengths 275-295 and 350-400 nm, respectively) and DOC-specific UV-absorbance (SUVA-254) were used to examine seasonal and spatial relationships between mercury and DOM. SUVA-254 and SR have been positively and negatively correlated, respectively, with increases in terrestrially-derived DOM. The downstream decrease in filter-passing Hg was not related to changes in DOM concentration or composition. In October 2010 and January and October 2011 filter-passing MeHg was significantly correlated ($p < 0.05$) with the slope ratio and SUVA-254, however these correlations were not significant in April 2011 or August 2011. We attribute this lack of correlation to the decreased influence of the terrestrial environment on DOM inputs during the drier season (summer-fall). The data also suggest that the dominant source of DOM and MeHg input to the creek varies with seasonal changes to local scale hydrology. During wetter months the creek may be better connected to adjacent floodplains and allochthonous, terrestrial inputs may have a greater influence. Conversely, in drier months, adjacent floodplains are hydrologically isolated from the creek and autochthonous DOM and in-stream MeHg production (in sediments and/or periphyton biofilms) may be more important. The increase in sampling frequency initiated in December 2011 will enable a more comprehensive examination of seasonal differences in the relationship between Hg, MeHg and DOM during base flow conditions. A gauged sampling station, with a stilling well and pressure transducer to measure discharge and in situ sondes to measure DOM fluorescence, turbidity, pH, conductivity, temperature and dissolved oxygen, has also been established to examining these same relationships under high flow events.