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185 - Potential impacts of sea level rise on arsenic mobility and cycling

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Abstract: Climate change induced sea level rise (SLR) is a global issue, particularly as the percentage of the world's population increases in coastal areas. In the United States, over 53% of the population lives along the coasts. Seas are expected to rise up to 1 m this century. In the Mid-Atlantic Region of the USA, SLR is increasing at a faster pace than in other parts of the world due to both climate change and subsidence. A multitude of historic industrial sites along the coasts of this region are contaminated with trace metals and organic chemicals. The first impacts of SLR will be alterations in sub-surface hydrology and chemistry, due to salinization and rising water tables. These events could lead to the release and migration of sediment-bound contaminants through ion-exchange and sorption/desorption processes that alter contaminant speciation, mobility, and toxicity. Arsenic contaminated soils, from abandoned industrial sites along Delaware's coast and within the 1.0 m SLR scenario, were reacted with seawater of varying ionic strength using microcosm reactors. Eh was varied to reflect inundation and retrenchment scenarios. Effluent and solid samples were collected at various times for analyses. Effluent was analyzed via ICP-MS to monitor changes in As mobility. Solid phase samples were analyzed by synchrotron-based micro-X-ray fluorescence (XRF) and X-ray absorption spectroscopy (XAS) to determine metal(loid) distribution and direct speciation, respectively, under different environmental conditions. Low seawater treatments showed no detectable desorption. Soils exposed to 100% seawater displayed an initial increase in As desorption, followed by a steady release for the duration of the trial (48h). Arsenic oxidation state shifted from As(III) to As(V) as Eh increased from anoxic (-300mV) to oxic (+300mV). These studies provide important information on the impact of SLR on the cycling, mobility, and speciation of redox sensitive heavy metals in contaminated soils.