Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23860

Determining mercury loading and source trends from new and historical concentration and isotopic records of Savannah River Site environmental matrices

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The Department of Energy-managed Savannah River Site (SRS) has supported nuclear material production since the 1950s and presents a unique opportunity to study environmental effects of anthropogenic activity through both background/"clean" samples and those perturbed by historic nuclear processing. Proximity to nearby cities and the Savannah River has driven monitoring and distribution characterization of chemical species harmful to human health that may be increased above background levels due to SRS activities. Mercury (Hg) is valuable for contamination monitoring due to its high sensitivity to background aberrations from nuclear processes. In addition to legacy SRS operations, Hg concentrations and compositions at SRS may also reflect offsite point sources and atmospheric deposition [1]; however, the contributions and roles of these sources to legacy Hg observations within the SRS environment are controversial. While Hg analysis has traditionally been limited due to practical difficulties in sample preparation and isotopic analysis, recent developments present alternative Hg analysis methods [2]. Here we utilize a rapid, high-fidelity method for both total Hg concentration and isotopic composition determination integrating a direct mercury analysis system (DMA) and multicollector–inductively coupled plasma–mass spectrometry (MC-ICP-MS). Determination of stable Hg isotope ratios in various environmental media proves useful in tracing Hg source(s) and processes involved in the transfer of Hg into the environment [3]. Insight into contaminant provenance is also a requisite for improving characterization, validating risk assessment modeling, selecting remedial techniques, understanding biogeochemical processing, and apportioning anthropogenic activities. In this study, we determine the concentration and stable isotopic composition of Hg in strata of various SRS environmental matrices and explicate the relationship of possible sources and trends of Hg loading in the SRS environment over past decades.

[1] Halverson, N. (2008), Final Report on the Aquatic Mercury Assessment Study. [2] Enrico, M., et al. (2017), *Analytica Chimica Acta* 1154. [3] Blum, J. D., et al. (2014), *Annu. Rev. Earth Planet. Sci.* 42, 249-269.