Presentation Type:

Poster

Track:

Special Symposium

Session:

TVA Kingston Fly Ash Release: Environmental Studies in Progress

Abstract Title:

Distribution and chemical characterization of fly ash bottom sediments

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Abstract:

The fly ash spill on December 22, 2008, from TVA's Kingston Power Plant, released about 4.1 million m^3 of coal fly ash slurry into Watts Bar Reservoir, principally into the Emory River. Within 3.2 km the Emory River discharges into the Clinch River, which flows into the Tennessee River after several kilometers. Following several high flows and initial fly ash dredging operations we began characterizing ash distribution within the affected rivers using a combination of high-resolution seismic reflection profiles correlated against actual stratigraphy logged via box, gravity, and vibra-cores. To date we have determined that fly ash from the release forms a discontinuous drape <30 cm thick in the lower 1 km of the Emory River. Within the downstream reaches of the Clinch and Tennessee Rivers, the ash is almost exclusively mixed with native sediments. Where such mixtures occur, the seismic profiler was unable to distinguish between the ash/sediment mixture and native sediments. Microscopy of river sediments ≈8 km downstream of the power plant indicates that trace amounts of older ash deposits extend to depths ≥1.5 m below the river bed where cores terminate on gravel containing chert, slag and coal. Selected river sediments with variable amounts of ash were collected along downstream profiles for analysis of trace elements in four sequential extractable phases ranging from water-extractable to reducible (0.1 M NH2OH·HCl dissolved in 25% acetic acid). Reducible As concentrations were generally higher in sediments containing greater levels of fly ash (2.38 – 6.56 mg kg-1 relatively pure ash; 0.25 – 3.00 mg kg-1 high ash – sediment mixtures; 0.14 – 1.53 mg kg-1 low ash – sediment mixtures; and 0.12 – 0.18 mg kg-1 predominantly native sediments). Similar trends were found for water extractable and readily exchangeable (1 M NH4Ac, pH=7) As. Results for Cd, Cu, and Pb provide no evidence that higher ash concentrations affected metal concentrations for any of the extractable fractions. The ratio of water

extractable to reducible trace elements in bottom sediments was higher for As and Cu compared to Cd and Pb, while the ratio of readily exchangeable to reducible concentrations was higher for Cu and Cd compared to Pb and As; these ratios were unaffected by ash levels. There were no discernable trends in any of the labile fractions of trace elements downstream of the spill source except that all reducible elements were higher in the Clinch River compared to the Emory and Tennessee Rivers.