Presentation Type:

Poster

Track:

Special Symposium

Session:

TVA Kingston Fly Ash Release: Environmental Studies in Progress

Abstract Title:

Evaluation of potential toxicity of fly ash released to the Emory River, TN, to benthic invertebrates in whole-sediment and elutriate exposures

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Abstract:

Fly ash was released to the Emory River, Tennessee, from the Tennessee Valley Authority Kingston Fossil Plant on December 22, 2008. The impact of this release on the river ecosystem is under investigation. The objective of this study was to evaluate the potential toxicity of fly ash in whole-sediment and elutriate toxicity tests conducted with benthic invertebrates. Chronic whole-sediment toxicity tests were conducted at the Columbia Environmental Research Center (CERC) with amphipods (*Hyalella azteca*) and two juvenile mussels (rainbow mussels, *Villosa iris* and wavy-rayed lampmussels, *Lampsilis fasciola*) for 28 d, and conducted with midge (*Chironomus dilutus*) for 10 d. Organisms were exposed to one ash sample collected from an ash-contaminated site in the Emory River and one control sediment (West Bearskin Lake, MN). Mean 28-d survival of amphipods (68%) in the ash sample was significantly lower than the control (98%), whereas the other three tested species exhibited 95 to 100% survival in the control and ash samples. The analyses of growth data are ongoing. A 10-d whole-sediment toxicity test was also conducted at Engineer Research and Development Center (ERDC) with amphipods exposed to two ash samples and one control sediment (Browns Lake, MS). Similarly, mean 10-d survival of amphipods (78%) in two ash samples was significantly lower that the control (99%). Concentrations of arsenic in ash samples (71 to 100 mg As/kg dry weight) and in pore water (184 µg As/L) were above the empirically based sediment probable effect concentration (PEC, 33 mg As/kg dry) and U.S. EPA chronic

water quality criteria (WQC, 150 µg As/L at hardness 100 mg/L). Concentrations of cadmium, copper, lead, nickel, zinc, and mercury were below their respective PEC or WQC. Additionally, a 10-d static-renewal toxicity test was conducted at CERC with 5-month-old rainbow mussels exposed to two elutriate samples which were prepared to simulate an extreme re-suspension event of fly ash from the Emory River and the sluice channel that might occur during dredging to remove fly ash. The elutriates contained elevated concentrations of several metals (e.g., arsenic, selenium, and barium) relative to local soil and sediment. Mean 10-d survival of mussels (based on foot movement or heartbeat) ranged from 90 to 100% and was not significantly different among reference site water (0% elutriate) and 10%, 50% or 100% elutriate concentrations for both elutriate samples. However, significantly lower percentage of mussels (35%) moved their foot muscles in 100% elutriate from sluice channel compared to mussels in reference site water (88%). These results indicate that fly ash can be chronically toxic to some sediment-dwelling organisms, probably due to elevated concentration of arsenic and/or physical characteristics of the fly ash. However, the short-term release of contaminants during re-suspension of fly ash may not adversely affect the survival of juvenile mussels.