Abstract

Integrated studies of the chemistry, leachability, bioavailability, and toxicity of fly ash hold much promise for the development of predictive models to guide improved management practices. A useful set of tools on which to base these integrated studies are modern spectroscopic techniques, which allow for the direct and non-destructive determination of the chemical forms of potentially toxic trace elements like arsenic, chromium, zinc, copper, and selenium in fly ash. This capability provides unprecedented insights into the chemical speciation of trace elements, information that is critical to accurately predicting the behavior of fly ash as it weathers, and the transport and ultimate fate of released trace elements in the environment. This proposed research program links chemical speciation to trace-element solubilization, bioaccumulation, and toxicity by coupling rapidly emerging x-ray analytical tools with dissolution and biological uptake experiments. Fly ash samples will be extensively characterized using advanced x-ray absorption spectroscopy (XAS) approaches. The characterized material will be utilized in fly ash weathering experiments where the kinetics of trace metal dissolution will be measured under conditions meant to simulate environmental conditions. Water samples generated in the weathering experiments will be directly used to study bioaccumulation and toxicity of dissolved trace elements to aquatic organisms. This integrated, multidisciplinary approach can lead to the development of generalized geochemical models for predicting trace-element mobility from fly ash and improved management practices for its disposal.