Abstract

Geochemical and Isotope Characterization of TVA Coal Combustion Products: Identification of contaminants and modeling their fate in the environment

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Over five hundred power plants nationwide generate approximately 130 million tons of Coal Combustion Products (CCPs) each year, 43% of which is recycled into other materials while the remaining 70 million tons is stored in 194 landfills and 161 ponds in 47 states (Lombardi, 2009). In most cases, water resources associated with CCPs' holding ponds and landfills are not monitored, and thus the environmental impacts of potential leachates generated from CCPs are unknown. In many cases however, degradation of water quality and/or bioaccumulation of toxic metals from contaminated sediments are not necessarily related directly to CCPs. This proposed project seeks to develop geochemical and isotopic tracers in order to evaluate the long-term environmental impacts of CCPs storage in holding ponds and disposal in landfills, model the fate of metals and metalloids in leachates originated from coal ash based on empirical and laboratory experiments, and establish diagnostic tools for delineating the sources of contaminants in the environment. The project is focused on TVA coal ash and is designed to provide TVA with a comprehensive database of the abundances of inorganic contaminants in CCPs that are produced in TVA coal-fired plants and their impact on the environment. The results of this project will provide an in-depth evaluation on how different coal sources and their major chemical composition control the levels and abundances of CCPs contaminants, the environmental conditions in which the CCPs contaminants are mobilized, and possible fate of these contaminants in aquatic systems. In addition, this project proposes a novel approach utilizing geochemical and isotope fingerprinting of CCP contaminants, which include boron, strontium, radium, and mercury isotopes. The combined geochemical and isotopic approach would provide TVA and others a unique monitoring tool for the identification of CCP contaminants in the environment and delineation of the contribution of other possible pollution sources that may also affect the environment. This proposal is also based on promising preliminary results that are based on both field work at Kingston, TN and laboratory leaching experiments that demonstrate the ability of boron, strontium, and mercury isotopes to trace the origin of contaminants in the environment. Knowledge of the CCPs composition, possible links to the coal sources, and the quality of effluents that are produced in TVA holding ponds would provide TVA with much better management tools and adequate preparations for expected future EPA legislations, in which discharged effluents from CCPs ponds will be regulated.