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The Effects Of Coal-Fired Power Plant Emissions And Fly Ash On A Regional Watershed

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The use of coal as a source for power generation has increased as U.S. energy demands continue to grow. Extensive coal reserves in localized regions of the eastern U.S. have attracted large scale power plants. A relict of intensive mining is often large areas of abandoned and unreclaimed mines. The combination of nearby coal reserves and accessible low-cost abandoned mines provides an ideal location for power generation and fly ash disposal. Fly ash, or coal combustion residue (CCR), concentrates inorganic non-combustibles such as heavy and trace metals. This increases the potential for localized environmental damage if emissions and fly ash reach the environment in appreciable amounts. In order to assess the impact of coal power production on local watersheds, the major element, trace metal and isotopic chemistry of a regional reservoir. The focus of the study involved quantifying the effects of fly ash deposition and inorganic aerosols from power plant emissions and mine reclamation by observing spatial variations in precipitation, surface sediments and water chemistry. Major cations and anions were determined by ion chromatography while trace metal analysis was performed using an ICP-MS. Several samples of airborne particulates were collected and analyzed using an SEM in an attempt to identify any size-dependent chemical compositional variations as well as examine particulate sources and potential environmental and human toxicity. A sediment core from within the reservoir was collected to determine if temporal variations in metal chemistry have occurred in recent decades as coal-fired power production and fly ash mine reclamation commenced. Lead isotopic analysis of surface and core sediments show a dramatic source change over the past century from smelter Pb to a more recent fly ash/gasoline source. Further results indicate that the reservoir water meets EPA standards due to the high Kd for most metals while younger sediments within the sediment core show higher levels of many trace metals in concert with variations in lead isotopic compositions. Collected particulate matter indicates a correlation between smaller grain sizes (less than 10μm) and trace metal enrichment.