Characterization of Feed Coal and Coal Combustion Products from a Power Plant Utilizing Northern Appalachian Basin Coal: A Mass Balance Approach

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ABSTRACT

Understanding elemental partitioning in feed coals and coal combustion products (CCPs) in coal-fired power plants is necessary for making informed decisions concerning the potential release of elements to the environment. As part of a national project, feed coals and CCP's from a power plant utilizing high-sulfur content (3.8 percent) Pittsburgh coal were analyzed for major, minor, and trace elements. The samples were collected twice weekly over an 8-week period from a 1300-megawatt steam generator operating with electrostatic precipitator and flue gas desulfurization (FGD) systems. Analyses for nine sample sets (a total of 36 samples, each set consisting of feed coal, economizer fly ash, fly ash, and bottom ash samples) were used in a mass balance calculation to determine the partitioning of trace elements. The mass balance was based on estimates provided by the power plant indicating percentages of feed coal ash captured in bottom ash (~20%), economizer fly ash (2-3%), and fly ash (~80%). Results are preliminary and do not take into account capture of elements by the FGD system. The uncertainty for the results of these calculations may be as high as 20%. The data suggest that close to 100 percent of Fe_2O_3, SiO_2, K_2O, and TiO_2 is retained in CCP's, primarily in fly ash. Arsenic and other sulfides are also captured to a large degree in fly ash (60% or more), and more than 90% of mercury and 80% of selenium are estimated to remain in the flue gas before entry into the FGD system. Work is in progress to compare these results to those of other power plants and determine the mode of occurrence of environmentally sensitive trace elements.