

Arsenic, Mercury and Other Trace Metals in Coal: Environmental and Health Implications

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ABSTRACT

The form in which trace metals are present in coal plays an important role in determining the environmental, economic and health impacts of coal and coal combustion products. Using an integrated approach involving combined microanalysis, bulk chemical analysis, selective leaching, and in some cases, XAFS analysis, we are quantifying the distribution of potentially harmful metals in these materials. Electron microprobe analysis and other direct methods provide quantification of arsenic in pyrite, the primary source of arsenic in bituminous coals. Using laser ablation ICP-MS, we have recently made direct determinations of mercury (in the ppm range) in individual pyrite grains separated from several U.S. coal samples. Similarly, we have used SHRIMP-RG ion microprobe analysis to quantify the association of chromium with illite-smectite in coal. These approaches have a direct bearing on environmental and health issues associated with coal and coal use. For example, understanding the distribution of mercury in feed coals is needed to devise effective strategies to limit mercury emissions from power plants. This information is also needed as input to models currently being developed to predict the behavior of metals during coal cleaning and combustion. The fundamental transformations that take place in the combustion zone are a function of the element form and distribution in the coal and combustion conditions, and are reflected in the resulting ash mineralogy and chemistry.