

# Mode of Occurrence of Arsenic in Feed Coal and its Derivative Fly Ash, Black Warrior Basin, Alabama

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## **ABSTRACT**

The phase residence and chemical form of arsenic (As) in coal and fly ash will strongly influence releases of As to the environment or As-related health risks resulting from coal utilization. In order to better document changes in the modes of occurrence of As during coal combustion, a washed and coarsely crushed bituminous feed coal (As=55 ppm), and its derivative baghouse fly ash (As=225 ppm) were selected for detailed comparative analysis. The coal is from the Pratt Group of the Black Warrior Basin, Alabama and is enriched in As compared to average U.S. coal (24 ppm, USGS database). Pulverized coal was burned in a pilot-scale (3.5 ft x 26 ft) combustor operated by the Southern Research Institute. Concentrates of pyrite from the coal and sieved size fractions of the fly ash were examined in detail to determine arsenic mode of occurrence. Electron microprobe analyses of twelve large (250-500 microns) pyrite grains and fragments (88 analyses) indicated concentrations of As ranging from 0.1-0.9 wt. percent. In contrast, very small (<25 micron) grains of framboidal pyrite contained <0.1 wt. percent As. The twelve large pyrites averaged 0.27 wt. percent As. Pyrite of this concentration could account for all the As in the coal if present in 2 wt. percent abundance. The coal contains 0.8 wt. percent pyritic S, which equates to 1.5 wt. percent pyrite. Silicate glass or arsenate compounds are possible hosts of As in fly ash. Their relative importance will be evaluated using selective extraction experiments, XAFS spectroscopy, and microanalysis with laser-ablation ICP-MS.