

A Sulfur Isotope Mixing Model to Trace Leachate From Pressurized Fluidized Bed Combustion By-Products in an Abandoned Coal Mine Setting

Ralph J. Haefner

U.S. Geological Survey, Water Resources Division, 975 West Third Avenue, Columbus, Ohio 43212

KEYWORDS: PFBC by-product, sulfur isotopes, environmental tracers, ground water

ABSTRACT

Approximately 125 tons per acre of pressurized fluidized bed combustion (PFBC) by-products were applied to a seven-acre abandoned coal mine in eastern Ohio during reclamation. The purpose of the application was to help raise pH and allow for reestablishment of vegetation. To trace leachate derived from the by-product, sulfur isotope ratios ($\delta^{34}\text{S}$) were measured from solid-phase materials and water samples. The $\delta^{34}\text{S}$ value for the PFBC by-product ranged from +4.6 to +4.8 per mil. Spoil samples collected from outside the application area had $\delta^{34}\text{S}$ values less than +3.2 per mil. Unsaturated-zone waters within the application area had isotope signatures representative of the PFBC by-product whereas similar waters from outside the application area had signatures representative of the spoil. A sulfur isotope mixing model indicated that up to 75 percent of the sulfate in application area unsaturated-zone waters was derived from PFBC by-product leachate. Sulfate concentrations in ground water increased after reclamation; however, the sulfur-isotope data indicated that only small amounts of sulfate in ground water were derived from leaching of the PFBC by-product. Therefore, increase of dissolved sulfate in the ground-water system was due to reclamation activities, not addition of the PFBC by-product.