Mineralogy of ash columns after exposure to AMD

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The purpose of this study was to investigate the potential for control of surface AMD by employment of FA as ash walls within coal mine spoil heaps as an in-situ barrier for passive treatment of AMD flows or as backfill material in mines. Long term performance and stability determination are necessary to assess the feasibility of application of FA and establish criteria for safe applications. Column tests were performed and showed that passive treatment of AMD (both real and simulated) is possible with the same reduction in contaminants and dissolved constituents as is found in active treatment systems. A further aspect of the study aimed to determine the potential environmental impact, as well as mineralogical and other changes associated with ash placements.

Duplicate columns (1.5, 1, 0.5 and 0.25 m) were packed with three different FA sources and several different qualities of AMD percolated through. Iron was found to precipitate in the first section of the columns, pH increased to >12 followed by a slow decrease. After an initial peak the EC showed a decreasing trend. Sulphate concentrations in eluents decreased sharply until the alkalinity was exhausted. Fe and Al were totally removed as well as the majority of toxic elements. Al, Fe, Mn & Zn, as well as Be, Cd, Co, Pb and Ni decreased to undetectable levels. Boron, Strontium and Selenium show no clear removal trend. Barium was not removed from the AMD. Passive treatment using fly ash is a feasible means of AMD control. Trends are consistent, with major, minor and most trace elements being well removed from AMD by all ashes. Removal is sustained until alkalinity is exhausted. Break-through of contaminants depended on column length, volume of AMD treated and ash type.

After the end of the percolation studies (ref…) samples were taken from the top, middle and bottom layers of each column and SEM, Raman, FTIR, XRF and XRD analysis performed. It was found that Sulphate precipitated as Gypsum and Ettringite as an intermediate phase. Iron precipitated as Hematite or Maghemite, as well as other iron rich amorphous phases. Other crystalline phases formed were Calcite, Calcium Aluminium Oxide and quasi-amorphous aluminium and iron rich phases. Silica and Titanium dissolution was observed. High amounts of Si and Al were observed in the bottom layers of the columns indicative of Si dissolution. The mineralogy of the columns will be presented.

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