

A LABORATORY INVESTIGATION OF THE EFFECT OF Fe^{+2} , Fe^{+3} , AND Al^{+3} ON THE PERFORMANCE OF ANOXIC LIMESTONE DRAINS

by

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ABSTRACT

Anoxic limestone drains have been shown to effectively add alkalinity to acid mine drainage. Due to the relative low cost of limestone compared to lime, sodium hydroxide, and sodium carbonate, limestone has been used to try to treat mine drainage for many years. However, armoring of limestone with ferric hydroxides has severely limited its effectiveness. Recently, anoxic limestone drains have been installed at many mine sites. These drains intercept mine water in a chemically reduced state (i.e. iron in the ferrous form and very low levels of dissolved oxygen). The Bureau of Mines has visited and sampled several drains in Pennsylvania, Ohio, and Tennessee. Three drains in Pennsylvania have been monitored intensively for nearly two years. Based upon field data, conversations with others involved in building and monitoring drains, and the chemical equilibria of contaminants common in mine drainage, several factors that may limit the effectiveness or longevity of these drains have been identified. These include armoring and/or clogging of the drains with ferric hydroxide, aluminum hydroxide, and calcium sulfate (gypsum). Laboratory tests which exposed limestone to solutions of ferrous, ferric, and aluminum sulfate under anoxic conditions have been conducted. These solutions (pH 2.2) were flowed through duplicate columns containing high-calcium-carbonate limestone. Influent and effluent water samples were analyzed for pH, alkalinity, ferrous and total iron, aluminum, calcium, magnesium, and sulfate.