WATER QUALITY CHANGES IN A COMBINED ALKALINE INJECTION TECHNOLOGY-REDUCING AND ALKALINITY PRODUCING SYSTEM (AIT-RAPS)[1]

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Abstract. Alkaline injection technology (AIT), the introduction of coal combustion products (CCP) into an underground mine pool, is a novel *in situ* treatment process for remediating acid mine drainage (AMD). The highly alkaline nature of some CCPs neutralizes acidity and precipitates metals prior to discharge. Also, for certain net acidic waters, reducing and alkalinity producing systems (RAPS) successfully sequester metals and generate alkalinity. Water quality improvement has been demonstrated for each of these stand-alone technologies. However, no information exists about the possible effects of their use in combination, i.e., an "AIT-RAPS". AIT has treatment limitations and a finite lifetime; RAPS may serve as a complimentary and backup system. To address an AMD problem in eastern Oklahoma, 2,200 mtons of fluidized bed ash was injected into an underground coal mine in early 2002. In late 2002, a five-cell RAPS (total surface area 3100 m^2) received the now treated discharge. Water quality samples were collected at the mine discharge and at multiple locations in the RAPS for analysis of total metals, major anions, sulfide, and oxygen demand. After 20 months, AIT has reduced metals loading and acidity while increasing pH and alkalinity, but certain metal concentrations in the mine discharge have noticeably increased recently. The RAPS positively affected the metal load it received and significantly lowered sulfate concentrations. However, the vertical flow cell components of the RAPS produced significant biochemical oxygen demand and dramatically increased concentrations of hydrogen sulfide. These changes may be due to a combination of decreased metal loading and specific design parameters (i.e., use of an exceedingly labile carbon source). The combined AIT-RAPS may serve to prolong the life of any single passive treatment technology. However, specific design guidelines must be developed and the monitoring of atypical non-target water quality parameters must be considered in its application.

Additional Key Words: mine drainage treatment, water quality improvement

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