OPTIMIZATION OF A PULSED LIMESTONE BED REACTOR AT THE ARGO TUNNEL IN IDAHO SPRINGS, COLORADO[1]

A. W. Miller[2], P. L. Sibrell, T. R. Wildeman

Abstract: Historic mining activity in the Clear Creek watershed west of Denver, Colorado has resulted in generation of acid rock drainage (ARD) from the abandoned workings in the area. A significant portion of ARD is discharged from the Argo Tunnel, near Idaho Springs, which was originally built in the early 1900s to drain the mines in the area. The State of Colorado and the Environmental Protection Agency currently operate an acid neutralization plant to treat the Argo Tunnel discharge at an approximate cost of $1 million per year. Recently, the U.S. Geological Survey Leetown Science Center, in partnership with the EPA, State of Colorado and the Colorado School of Mines, has transported a portable pulsed limestone bed (PLB) ARD treatment system to the site for process evaluation and demonstration. Preliminary tests were conducted in late summer 2004 and indicated that reagent costs could be cut considerably by pretreatment of the water with the system. A full suite of tests was conducted during summer 2005 to investigate the effects of water treatment rate and carbon dioxide addition on acid neutralization, metal removal and sludge generation. Effluent pH was in the range of 5.1-7.3, and alkalinities were in the range of 20-170 mg/L as $CaCO_3$. Metals removal for iron and aluminum were >98%. Copper had removals of 50 to >99% while zinc had removals from 5 to 65%. Manganese concentrations were generally unaffected. The effluent of the limestone reactor required post-treatment with lime to raise the pH high enough to remove zinc and manganese to dischargeable levels. The sludge from the limestone/lime treatment scheme had settled volumes that were 60% of the lime treatment alone and also settled at a faster rate. These results confirm that treatment costs at the Argo plant could be significantly reduced by pretreatment with the PLB system. Further tests to be conducted in summer 2006 will investigate effects of sludge filterability as well as alternate post-treatments for the removal of zinc and manganese and to bring the PLB effluent to discharge standards.

Additional Key Words: acid mine drainage, mining impacted water, treatment, fluidized bed reactor, limestone

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[2]Andy Miller, Graduate Research Assistant, Environmental Science and Engineering Division, Colorado School of Mines, Golden, CO 80401, e-mail: amiller@mines.edu.; Philip Sibrell, General Engineer, US Geological Survey, Leetown Science Center, Kearneysville, WV, 25430, e-mail: psibrell@usgs.gov; Thomas Wildeman, Professor, Department of Chemistry and Geochemistry, Colorado School of Mines, Golden, CO, 80401, e-mail: twildema@mines.edu.

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