

REMEDICATION OF ACID MINE DRAINAGE USING SULFATE-REDUCING BIOREACTORS - CASE EXAMPLE: THE TAB-SIMCO PASSIVE TREATMENT SYSTEM¹

Paul T. Behum,² Lawrence Lewis, and Ron Kiser, and Lilianna Lefticariu

Abstract: Tab-Simco is an abandoned coal mine located southeast of Carbondale in Jackson County, Illinois. Underground mining of two coal beds of the Pennsylvanian age Spoon Formation occurred between 1890 and 1955; surface coal mining re-affected the area in the 1960's and 1970's. Acidic mine drainage (AMD) discharges from the mine workings at a rate of about 35,000 gallons per day, impacting aquatic life in Sycamore Creek. The largest two AMD discharges (19 GPM) had a pH = 2.4, dissolved iron = 422 mg/L, dissolved aluminum = 147 mg/L, dissolved manganese = 31.4 mg/L, sulfate = 2,370 mg/L, and total acidity = 1,816 mg/L calcium carbonate equivalent (CCE, median values). This discharge flowed across a floodplain, creating a 9-acre area "kill zone" devoid of vegetation. Although significant metal load reduction occurred within this zone by suspected low-pH iron oxidation, low pH (2.48) AMD remained and a passive-type treatment system was constructed in 2007 by the Illinois Department of Natural Resources, Office of Mines and Minerals to remediate the problem. The principle technology employed is a 0.75-acre sulfate-reducing bioreactor, which is one of the first full-scale systems applied for coal mine AMD abatement in the US. A series of oxidation cells follow to precipitate most of the remaining metals. Over 4 years of operation approximately 99.1 percent of the iron, 99.4 percent of the aluminum, and 44 percent of the sulfate was removed. However, there has been a steady decline in bioreactor discharge alkalinity from >400 to <150 mg/L CCE, which has led to a decline in system discharge water quality. Although the treatment system is currently discharging net acidic water (net non-Mn acidity = 30 mg/L CCE), during the wet season Sycamore creek contains the buffering capacity necessary to accept this acid load.

Additional Key Words: Low-pH iron oxidation and passive treatment.

¹ Paper was presented at the 2012 National Meeting of the American Society of Mining and Reclamation, Tupelo, MS. *Sustainable Reclamation* June 8 – 15, 2012. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

² P.T Behum, Environmental Resources and Policy PhD Program, Southern Illinois University and Sr. Hydrologist, Office of Surface Mining Reclamation and Enforcement; Lawrence Lewis, and Ron Kiser Illinois Department of Natural Resources, Office of Mines and Minerals; Lilianna Lefticariu Assistant Professor, Department of Geology, Southern Illinois University, Carbondale, Illinois.