WATERSHED-SCALE ENVIRONMENTAL MONITORING TO PRIORITIZE MINE DRAINAGE PASSIVE TREATMENT IMPLEMENTATION[1]

R.W. Nairn, K.A. Strevett, J. LaBar, A. Sutter, J. Clifton, W. Strosnider, J. Brumley, D. Lutes, B. Santamaria, J. McAllister, A. Brewer, M. Roberts, and K. Kauk[2]

Abstract: As part of a large multi-entity, multi-year effort to address environmental contamination in a portion of the Tri-State Mining District, we conducted regular water quality and quantity evaluations of several hard-rock mine drainage discharges and in-stream locations for the main stem of Tar Creek, its tributaries and streams in adjacent watersheds. Metals (Al, As, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, and Zn), anions (sulfate, nitrate, nitrite, phosphate, chloride, fluoride and bromide) and physical parameters (pH, Eh, T, SC, DO, turbidity, alkalinity), along with volumetric discharge rates, were monitored monthly from October 2004 to October 2007. Mine drainage discharges were determined to be net-alkaline with elevated Fe, Zn, Pb, Cd and sulfate concentrations and were typically characterized by elevated pCO_2 and seasonal hydrologic variability. Discharges were prioritized for passive treatment based upon contaminant loading to receiving waters and the likelihood of significant watershed-scale improvements. Conceptual passive treatment designs were developed for eight discharges and final engineering plans were completed for two discharges. All designs incorporate oxidative iron removal via aerobic mechanisms, and trace metal removal via reductive microbial and geochemical precipitation processes. Multiple process units in parallel trains allow for manipulation of system hydrology and sequential treatment options. Watershed-scale implementation requires meeting both technical and non-technical challenges.

Additional Key Words: hard-rock mining, oxidation ponds, vertical flow cells, iron, lead, zinc, cadmium

---

[1] Poster paper was presented at the 2008 National Meeting of the American Society of Mining and Reclamation, Richmond, VA, ***New Opportunities to Apply Our Science*** June 14-19, 2008. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502

[2] Robert W. Nairn, Associate Professor, Keith A. Strevett, Professor, Julie A. LaBar, Research Scientist and Alissa Sutter, Jonathan Clifton, William Strosnider, Jessica Brumley, Darcy Lutes, Beatriz Santamaria, Jennifer McAllister, Alex Brewer, MaKenzie Roberts and Kyle Kauk, Graduate Research Assistants, Center for Restoration of Ecosystems and Watersheds, School of Civil Engineering and Environmental Science, University of Oklahoma, Norman, OK, email:nairn@ou.edu.