IMPACTS OF REMEDIATED ACID MINE DRAINAGE ON BIOLOGICAL SYSTEMS WITHIN A SUCCESSIVE ALKALINITY PRODUCING WETLAND TREATMENT SYSTEM[1]

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Abstract: Exposure to heavy metals can lead to increased mortality and decreased normal physiological function in aquatic organisms. Acid mine drainage (AMD) contains a mixture of different inorganic contaminants including heavy metals. The impacts from untreated AMD on macroinvertebrate communities within natural waterbodies have been investigated extensively, and a number of different processes have been designed for the treatment of AMD. To address an AMD discharge from an underground mine in eastern Oklahoma, injection of an alkaline coal combustion product (CCP) was coupled with a five-cell reducing and alkalinity producing system (RAPS). This study was conducted to examine resulting water quality changes and biological responses. Grab samples were collected at multiple locations for metal, anion, sulfide, and oxygen demand analyses. Chlorophyll *a* concentrations were determined throughout the system to estimate trophic status. Artificial substrate samplers were deployed to quantify and evaluate colonizing macroinvertebrate assemblages within each cell of the system. *Corbicula fluminea* and *Lepomis macrochirus* were exposed to waters within each treatment cell. Mantel, foot, and visceral mass tissues were harvested for metals content analysis in *C. fluminea*, and liver tissues were collected from *L. macrochirus*. Water quality data indicated positive changes in quality of mine drainage. Productivity between treatment cells varied significantly. The cells receiving effluent from anoxic organic substrate conditions had elevated nutrient levels, which lead to elevated productivity. Chlorophyll *a* levels reached hypereutrophic conditons into final treatment cells. Macroinvertebrate community structured was significantly different among treatment cells. Primary cells produced more diverse and evenly distributed taxa, including the presence of moderately intolerant taxa. Organismal responses, such as heptaosomatic index, condition factor, and condition index, did not significantly vary among organisms exposed within different treatment cells. Trends of metal tissue accumulation, compared to water concentrations, were observed for a limited number of metals. Exposure and colonization experiments indicated that the RAPS were functioning by removing metals from the water column and decreasing potential impacts from mine drainage to biological systems.

Additional Key Words: coal combustion products, *Lepomis macrochirus*, *Corbicula fluminea, in situ* exposures

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[1] Paper was presented at the 2004 National Meeting of the American Society of Mining and Reclamation and The 25th West Virginia Surface Mine Drainage Task Force, April 18-24, 2004. Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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