STUDIES LEADING TO THE DESIGN AND CONSTRUCTION OF THE PASSIVE TREATMENT SYSTEM AT THE WEST FORK MINE, MISSOURI

by

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Abstract. Water from an underground lead mine has pH of 7.9 with 0.4 to 0.6 mg/L of Pb and 0.18 mg/L of Zn. A full-scale reactor, capable of handling 1200 gpm, using sulfate reducing bacteria was built to remove lead to below the environmental limit of 0.030 mg/L. Laboratory and pilot-scale studies were done prior to the design of the full-scale system. The laboratory studies showed that lead could be removed both aerobically with algae and anaerobically with sulfate-reducing bacteria. To minimize the surface area used, an anaerobic pilot-scale reactor was constructed. The system utilized 53 m^3 of a mixture of sawdust, manure, hay dolomitic tailings, and coarse mine waste. Throughout almost two years of year operation, the system has treated from 8 to 185 L/min of water, and lead and zinc have been reduced to below detection limits of 0.02 and 0.008 mg/L respectively. Because pH of the water was neutral and the loading of heavy metals was low, the sulfate reduction reaction: $SO_4^{=} + 2$ "CH_2O" $\longrightarrow H_2S + 2HCO_3^-$ (where "CH_2O" is used to represent organic matter) could be followed. Sulfide and alkalinity in the water increased as sulfate in the water decreased. When there was readily available organic nutrients in the system, sulfide production reached 2 moles sulfide produced /m^3 /day. When readily available organic nutrients were exhausted, biologic oxygen demand in the effluent water dropped to zero and sulfide production decreased to more typical design values of 0.3 moles sulfide produced / m^3 / day.

Additional Key Words: Sulfate reducing bacteria, heavy metals, lead, zinc, mine drainage

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