Three Year Performance Evaluation of a Sulfate Reducing BioReactor for Mine Water Treatment in PA: Sulfate Removal, Sulfide Control, and TDS Reduction[1]

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Abstract: A sulfate reducing bioreactor system was designed and constructed in 2014 to remove sulfate in alkaline mine water to 250 mg/L sulfate prior to discharge. The design elements were previously described and consist of a metals removal circuit, carbon feed circuit and twin bioreactors bedded with large cobbles and seeded with sulfate reducing bacteria but containing no additional carbon source. Biochemical performance to date has shown that sulfate reduction approaches 1500 mmol SO4 $m^{-3/}$day using ethanol, molasses or molasses plus ethylene glycol. After 3 years of operation, influent sulfate of 2800 mg/L is reduced to concentrations ranging from only 24 to 400 mg/L depending primarily on ambient temperature. Effluent metal concentrations were decreased to <1 mg/L Fe and <0.2 mg/L Mn. Effluent residuals such as sulfide (dissolved and gaseous) are removed using an additional iron bed circuit where removal of sulfide from 15 mg/L to <0.20 mg/L occurs with a 30 second contact time. Concerns over elevated TDS (via Osmotic Pressure) have led to testing passive methods for reducing salt in the effluent. To date, several zero valent iron powders have been used in different treatment system configurations to reduce effluent TDS by 35 to 60%.

Additional Key Words: SRB, bioreactors, AMD, sulfate reducing bacteria, mine waster, Osmotic Pressure, TDS, Zero Valent Iron

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