

IN SITU TREATMENT OF METAL MINE TAILINGS USING EOS^{®1}

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Abstract: Ore Knob Branch and Peak Creek within the New River Basin of North Carolina are impaired due to discharge of acid mine drainage with high iron (200-250 mg/L), aluminum (3800-4300 µg/L), copper (220-690 µg/L) and zinc (780-1000 µg/L) and low pH (2.9-3.1) from a tailings impoundment at the former Ore Knob copper/zinc mine. Surface runoff and groundwater from the upstream watershed percolates through the tailings, discharging as a series of small springs or seeps on the dam face.

A pilot study is being conducted to evaluate the potential for in situ anaerobic bioremediation within the tailings impoundment. Edible oil substrate (EOS[®]) will be injected directly into the tailings through a line of wells installed immediately upgradient of the embankment. EOS[®] is prepared from a mixture of easily biodegradable substrates (lactate and amino acids) and more slowly biodegradable emulsified soybean oil. In the field, the concentrated oil-in-water emulsion is diluted with plain water and then injected using temporary or permanent wells. As AMD flows through the treated zone, EOS[®] stimulates rapid growth of iron and sulfate reducing bacteria, increasing the pH, reducing sulfate, and immobilizing iron, copper, nickel, zinc and related toxic metals. The slowly biodegradable soybean oil present in EOS[®] provides a slow, steady supply of organic carbon to support long term treatment. All materials used in the process are Generally Recognized As Safe (GRAS), food-grade materials (21 CFR 184.1400) to aid in gaining regulatory approval for *in situ* application. Sufficient EOS[®] will be injected to last five to ten years.

Laboratory studies have demonstrated that this approach can be very effective in treating AMD, resulting in a dramatic increase in pH, and reduction in dissolved metals. In laboratory columns packed with acid forming mine spoils and treated with emulsified soybean oil, the pH increased from less than 3 to ~ 6, SO₄ was reduced by 80%, aluminum dropped from ~100 mg/L to below detection (<0.02 mg/L), and both copper and zinc dropped from ~60 mg/L to below detection (<0.02 mg/L).

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