

# A Permeable Reactive Barrier (PRB) for the Immobilization of Selenium in Seep Water and Shallow Groundwater at a Phosphate Mine in Southern Idaho: Results of Bench Scale Testing<sup>1</sup>

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**Abstract:** A bench study designed to determine the efficacy of a permeable reactive barrier (PRB) for removing elevated Se in groundwater and seep water at the toe of overburden storage area at a phosphate mine in Idaho. The bench testing was considered a first step in the pre-design considerations for developing an engineering and geochemical strategy for long-term water treatment options at the site. The study consisted of three main parts: (1) characterization work designed to determine the basic chemistry of the site-water under consideration and the components of the PRB, (2) batch leaching studies designed to assess the chemistry changes that each media component is expected to contribute to the overall effluent water chemistry, and (3) column studies in which mine seep or groundwater were delivered up-flow to columns packed with the PRB components. The column influent flow rate was set to establish a hydraulic residence times of 12 and 24 hours. The results of the studies indicated that the media components of the PRB caused no chemical changes of concern to effluent water quality. Column testing results indicated Se was rapidly reduced to elemental Se. The initial Se concentration in seep water was 9 mg/L and was reduced to about 0.2 mg/L after 25 pore volumes and 0.1mg/L after 50 pore volumes. Increasing the hydraulic residence time to 24 hr., decreased Se to 0.07 mg/L or just above the 0.05 mg/L water quality goal. The initial Se concentration in groundwater was about 1 mg/L and was reduced to less than 0.02 in the first 3 hours of column contact time, well below the 0.05 mg/L water quality goal. The presentation will provide details of the testing including Se reduction, the fate and stability of Se in the PRB and the initial design and performance of the field pilot constructed in September 2018<sup>3</sup>.

**Additional Key Words:** column and batch leaching, selenium reduction, selenium speciation, seep water, overburden, microbial reduction.

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3. Work reported here was conducted near 42° 44' 56" N; 111° 30' 23" W.