**In Situ Treatment of Selenium-Lysimeter Study**

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ABSTRACT

Thirty lysimeters were installed at the Hobet mine in southeast West Virginia in Spring 2010 to test for transport rate of selenium in mine-run interburden as well as selenium removal by adsorption to layered ferric oxyhydroxide (ferrihydrite). Each 16 x 24 foot cell contained about 61 tons (4 to 6 foot thickness) of interburden, overlaying various thicknesses (0.25, 2.25, 9, and 18 inches, plus a zero-amendment control cell) of fine-grained ferrihydrite from a limestone-treated acid mine drainage (AMD) wetland. The mass of ferrihydrite was 0 to 2.2% weight percent of the spoil. The control and each amendment were replicated 6 times, for estimation of uncertainty in reproducibility of results. Rainfall was collected on and infiltrated through these cells to create a leachate that drained to individual central collection tanks. Sampling was performed 46 times at approximate 2 week intervals from 2010-2012. Basal ferrihydrite layers in the three highest amendment categories successfully removed up to 76.9% selenium (in comparison to the unamended piles) from leachate by an adsorption mechanism. Results were somewhat variable for replicates. The higher amendment concentrations were demonstrably more effective, while the very-thin ferrihydrite-treated piles showed no significant reduction from unamended piles. Reproducibility of replicates was in general acceptable for both amended and unamended lysimeters.

This investigation was an experiment at field scale to test the effectiveness of a single basal ferrihydrite layer at reducing Se mobility in leachate derived from organic-rich shaly spoil. Thirty 24x16 foot lysimeters of identical construction, composition, and design, except for various thicknesses of ferrihydrite added, were monitored for 2.4 years on a bi-weekly basis. Key results include that:

* time series of Se concentration and flux are highest during late winter and spring months, attributed both to spring flush of overwinter reaction products and to elevated recharge. Se fluxes are strongly seasonal, and winter/spring measurements of flux are critical to long-term accurate estimation
* in a trial of 4 different layer thicknesses of ferrihydrite and one control (no ferrihydrite), the three thickest ferrihydrite amendments showed significant reduction in Se fluxes from the control, while the thinnest layer showed no reduction. The two thickest layers (9 and 18 inches) showed 59.4% and 76.9%, respectively, cumulative reduction in Se flux.

all results were couched in terms of mean results for 6 replicates in each treatment class. The uncertainty due to variability in materials, construction, and hydrology of individual lysimeters was quantitatively assessed and considered within acceptable limits. The differences found in mean Se concentration and flux are considered to have a high probability of significance