

EVALUATION OF LEACHATE CHEMISTRY FROM COAL REFUSE BLENDED AND LAYERED WITH FLY ASH¹

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Abstract: One widely proposed method to stabilize and reclaim acid-forming coal refuse piles in the Appalachians is to use alkaline fly ash as a liming agent within the refuse disposal fill. Significant amounts of fly ash and other coal combustion products have been back-hauled to the region under the assumption that net water quality effects will be positive. Previous lab column and field leaching studies by our group focused on bulk blending fly ash with acid-forming (pyritic) refuse. While this may be the preferable way to co-dispose the two materials, it is difficult to practically execute in the field. A better representation of field conditions is a “pancake layer” of ash above the refuse. A new leaching column study was initiated to evaluate the leachate chemistry from acid forming coal refuse-fly bulk ash blends vs. ash over refuse layers. On a 20% v:v basis, an acidic and alkaline ash were blended with, or layered over, acid-forming coal refuse and sandstone and packed into PVC columns (7.5 cm x 50 cm) which were leached with 2.5 cm DI water twice a week for 24 weeks. Leachates were analyzed for pH, electrical conductivity, and a suite of elements of concern with a focus on the oxyanions of As, Cr, Mo, and Se. A sequential extraction was performed on the four materials prior to leaching which showed a significant portion of the elements of interest residing in the residual fraction for the refuse and sandstone and in the Fe- and Mn-oxide bound fractions for the ashes. At the conclusion of the leaching phase, a second sequential extraction performed on the materials revealed a general trend for As, Cr, Mo, and Se to be associated with Fe and Mn oxide fraction to a greater extent than in the pre-leached materials. The refuse controls acidified within 4 weeks to approximately pH 2.0. Bulk-blended treatments maintained higher leachate pH than corresponding layered treatments. Significant As and Cr leaching only occurred in the refuse control columns, reaching as much as 30 mg/L in Week 8 for As, and 7 mg/L in Week 16 for Cr. Leachate Mo produced a spike of 13.4 mg/L from the alkaline ash control in the first leaching event, but all other leachates were < 2 mg/L. All refuse treatments eluted initial spikes of Se between 1 and 2.1 mg/L in the first week of leaching, but dropped to < 0.5 mg/L after 2 weeks for all treatments except the refuse control. These results show that significant leaching of As, Cr, Mo, and Se is unlikely as long as bulk solution pH is maintained between pH 4 and 12 for these materials. Bulk-blended treatments maintained a higher leachate pH than layered treatments, but there were no significant differences in oxyanion leaching between the two co-disposal methods over the course of this study. Blending of alkaline ashes, when feasible, with coal refuse would be the preferable co-disposal method to limit the leaching potentials of these potentially toxic trace elements, but layering of ash appears to also be an appropriate co-disposal method. Longer term column and/or field studies should be conducted to determine if there could be release of elements of concern under these conditions beyond the timeframe estimated by this study.

Additional Key Words: Coal combustion products, acid mine drainage, leaching columns, oxyanions, water quality.

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