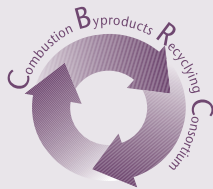


# Project Facts



*Promoting and supporting the commercially viable and environmentally sound recycling of coal combustion byproducts for productive uses through scientific research, development, and field testing.*



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## *Prediction of the Effects of Placing Coal Combustion Byproducts in Contact with Mine Spoil*

### **Project Objectives**

- Develop an understanding of the geochemical interactions between coal combustion byproducts (CCBs), mine water, and mine spoil/rock
- Better predict the benefits or impacts of specific CCB mine filling schemes through the sequential leaching of mine spoil/CCB mixtures with mine water associated with specific mining environments

### **Background**

While many leaching tests suggest the potential leaching of toxic elements from CCBs, it is extremely difficult to find evidence of harm to groundwater under field conditions. It is intuitive that adsorption to spoil significantly restricts the mobility of toxic ions at mine fill sites. Nonetheless, uncertainty regarding the mobility of trace elements in CCBs still remains the largest deterrent to widespread use of coal ash in large mine reclamation projects. Mine backfills are often complex chemical environments and until now there has been no accepted method to simulate these conditions in a laboratory environment. Therefore, questions remain regarding large volume use of CCBs during reclamation activities.

### **Description**

Several leaching tests can be used to predict the leaching behavior of solid materials. Most, such as the Toxic Character Leaching Procedure (TCLP) and the Synthetic Precipitation Leaching Procedure (SPLP) are single leach cycle tests, and they have no procedure for assessing interactions with spoil. The Mine Water Leaching Procedure (MWLP) was developed especially for these unique conditions. Researchers will determine if the MWLP can be used to predict the ability of mine spoil to retard toxic ion mobility at proposed CCB mine beneficial use sites. The research team also will quantify the magnitude of retardation for various ions and translate the results into protective recommendations for field deployment.

In earlier work, the MWLP was used to determine the chemical interactions between industrial waste byproducts and acidic mine water. While these tests can provide valuable information regarding the general leaching behavior of many byproducts placed in acidic mine environments, a method to empirically determine the effects of mine spoil on the mobility of the leached ions is needed. Preliminary work indicates increasing application of mine spoil to the leaching apparatus removes beryllium, nickel, and selenium that had been leached from the CCB. Documentation and quantification of these trends will be critical in assessing any possible risks associated with designing material placement schemes so as to maximize the beneficial aspects of using CCBs in mine fill reclamation projects.

### Preliminary Results and Status

Five different treatment ratios of CCB (Class F) and neutral, non-pyritic mine spoil are being subjected to MWLP in accordance with the proposal protocol and analyzed for trace elements, pH, alkalinity, and acidity to determine leachable element adsorption to mine spoil.

To date, MWLP sequential leachings are complete for the fly ash and sandstone spoil mixtures.

Figures 1, 2, 3, and 4 show preliminary fly ash, sandstone, and mixture MWLP leachate results for the trace elements beryllium, cadmium, chromium, and selenium. Sandstone spoil appears to increase the rate at which chromium and selenium are leached, whereas spoil material appears to decrease the rate of beryllium and cadmium leaching. The leaching rate of arsenic, copper, nickel, and zinc present in fly ash do not appear to be influenced by addition of spoil material.

Figure 1: 100% Ash

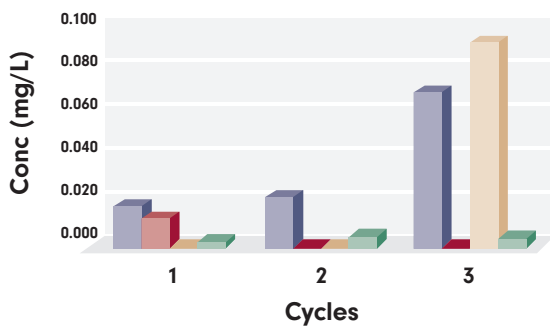


Figure 2: 50% Ash and 50% Sandstone

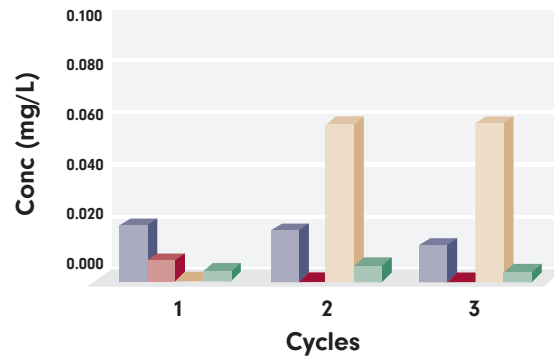


Figure 3: 25% Ash and 75% Sandstone

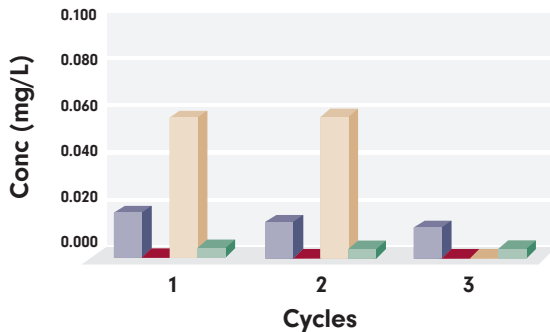
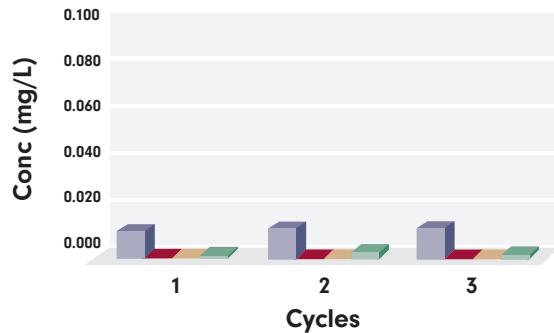


Figure 4: 100% Sandstone



■ = BERYLLIUM (BE)   ■ = CADMIUM (CD)   ■ = CHROMIUM (CR)   ■ = SELENIUM (SE)