

Fly Ash Characteristics and Carbon Sequestration Potential

Anthony V. Palumbo¹, James E. Amonette², Jana R. Tarver¹, Lisa A. Fagan¹, Meghan S. McNeilly¹, W. Lee Daniels³

¹ Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37830-6038;

² Pacific Northwest National Laboratory, P.O. Box 999, K8-96, Richland, WA 99354;

³ Virginia Polytechnic Institute and State University, Blacksburg, VA 2406 -0404

KEYWORDS: fly ash, carbon sequestration, ammonia, mercury, toxicity

ABSTRACT

We have been examining the potential for the use of fly ash in promoting carbon sequestration. Retrospective studies of fly ash applications indicate that fly ash may increase carbon sequestration in reclaimed mine soils. In laboratory studies we have examined both the potential for leaching of toxic metals and the carbon sorption properties from different types of fly ash. The fly ash originated from systems with and without NO_x removal equipment (high and low ammonia) and had pHs ranging from 3.7 to 12.4. We observed significant differences in the sorption of humic acids to the fly ash material. The Langmuir isotherm could be fitted to the sorption curves and maximum adsorption capacity was typically 800-1200 mg/kg. However, one high carbon content (as measured by loss on ignition) fly ash had a maximum sorption capacity of more than 3000 mg/kg. We also observed that leaching of Cr, Li, Pb, and Cd was significantly decreased upon mixing of fly ash with soil and phosphate fertilizer. Except for the fly ash at pH 12.4, we found little indication of toxicity as indicated by the Microtox[®] system. The toxicity was eliminated after neutralization of the leachate from this fly ash. Thus, with careful selection of both fly ash and application mode, fly ash is beneficial for carbon sequestration in reclaimed mine lands.

This research is sponsored by the U.S. Department of Energy, Office of Fossil Energy and DOE NETL. Oak Ridge National Laboratory is managed by the University of Tennessee-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

Submitted for consideration in the World of Coal Ash 2007 Conference, held May 7-10, 2007.