#1

TITLE: ELECTROKINETIC DENSIFICATION OF COAL FINES IN WASTE PONDS **DATE:** April 1996

PI: E. James Davis

STUDENTS: Timothy Johnson and Christopher Aardahl (partial support), Ph.D. Candidates

INSTITUTION: University of Washington
Department of Chemical Engineering, Box 351750
Seattle, WA 98195-1750
(206) 543-2250

GRANT NO.: DE-FG22-95PC95209

PERIOD OF PERFORMANCE: June 30, 1995 to March 28, 1996

I. ABSTRACT

OBJECTIVE: The objective of this research is to apply electrokinetics to remove colloidal coal and mineral particles from coal washing ponds without the addition of chemical additives. Colloidal particles do not settle gravitationally, but because their surfaces are charged one can produce settling by applying an external electric field. Of specific interest is a lake near Centralia, Washington used to wash coal prior to combustion in an electrical power generation facility. Laboratory experiments have demonstrated that electrokinetic treatment is feasible, so this project is examining how to scale up laboratory results to an industrial level. Electrode configurations, power requirements, and system properties are being studied.

WORK DONE AND CONCLUSIONS:
Preliminary work by the PI was done in the first three months, and graduate student involvement began after graduate students were recruited in October 1995. A laboratory test tank has been designed, and computerized data acquisition instrumentation and software (Labview) has been acquired, programmed and tested. Power supplies and other instrumentation have been obtained and are being installed. Instrumentation for the measurement of particle sedimentation velocities and particle concentrations by light-scattering techniques is currently being designed and built. Measurements of the relevant properties of the water and colloids have been made, including particle zeta potentials, particle sizes and the electrical conductivity of the lake water. A major effort involved the selection and design of the electrodes needed to generate the electrical field. The most suitable solution appears to be the use of woven sheets of carbon used in the aircraft industry to produce composite polymeric materials, but a polymeric coating must first be removed. The electrodes should be inert to avoid contamination of the process water by the products of electrochemical reaction. It is also important to avoid gas evolution at the lower electrode to prevent undesirable convection in the sedimenting slurry. Preliminary experiments are addressing the problems of the current densities and potentials needed to remove the colloidal particles at an acceptable rate while minimizing gas evolution and power consumption. Theoretical analysis of the process has been initiated.

SIGNIFICANCE TO FOSSIL ENERGY PROGRAM: Coal-washing facilities represent a significant source of water pollution in coal-producing areas. The removal of coal and mineral fines by electrokinetic methods produces clean process water which can be recycled without the addition of chemicals such as the flocculants used in sewage treatment. The process equipment can be expected to be simple in design, and for water containing relatively small amounts of dissolved solids the power requirements should be small.

PLANS FOR THE COMING YEAR:

- Laboratory apparatus will be completed and tested, and measurements of sedimentation rates will be made for various particle concentrations.
- Parametric studies of current densities, potential differences and other system parameters will be carried out.
- Techniques will be developed for examining the "microscale" of the process, including measurements of the local electrical fields.
- The effects of system parameters on the power requirements will be explored.

II. HIGHLIGHT ACCOMPLISHMENTS

As the project has only been in operation for six months, the major accomplishments are ahead, but design work and the development of a data acquisition system have been completed.

DISCLAIMER

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.