FINAL TECHNICAL REPORT
September 1, 2002, through November 30, 2003

Project Title: **OPTIMUM FILTRATION IN THE ISGS FILTER PRESS WITH DEWATERING AGENTS**

ICCI Project Number: 02-1/4.1A-1
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ABSTRACT

Fine coal is difficult to market because the high moisture content diminishes heating value, increases haulage costs, and makes handling difficult. Efficient removal of water from fine coal is necessary to produce a saleable product. The goal of this project was to advance the ISGS Intelligent Filter Press towards commercialized industrial use for reducing the moisture content of fine-grained coal. The results of the project led to improvements in the design of the press and to determination of the optimal operating parameters and dewatering agents that produce the driest filter cake possible in the shortest amount of time. Through testing of dewatering agents, it has been determined that non-ionic surfactants with HLB 11 are most effective at increasing the filtration rate while reducing the final moisture content of the filter cake. The cationic surfactant DTAC was also found to be effective. The success of this project also led to additional work on the design of an industrial-scale ISGS Intelligent Filter Press. Some components have been purchased in preparation for conducting demonstrations at various coal mines, utilities, and slurry pond reclamation sites in Illinois.

Pages 1 through 21 contain propriety information.

EXECUTIVE SUMMARY

Coal is an amorphous mass with fine-grained crystalline mineral impurities distributed throughout the coal matrix. Liberation of the fine-grained impurities increases when the coal is crushed to a fine particle size during mining, haulage and processing. However, these fine coal particles are not only difficult to clean, but with their relatively large external surface area, are also difficult to dewater after cleaning. Successes in fine coal cleaning are partially overshadowed by the limitations of existing dewatering equipment. Because of these limitations, rejection and impounding of fine coal at washing plants is a common practice. Disposing of fine coal in tailing ponds not only wastes material, which cost money to mine, but it also contributes to the environmental disruption of land and increases maintenance and reclamation costs.

Development of an effective filtration system for dewatering fine coal compliments the development of processes capable of effectively processing coal fines. Decreased costs for recovering cleaner fine coal with a low moisture content comes at a time when coal processing plants handle increasingly larger quantities of fine-grained materials generated either during mining, transportation, or processing, and when Illinois coal mines are closing because they cannot economically produce a clean enough product. On average, about 25% of the coal produced is lost during processing because equipment which can effectively and economically process fine coals is not available. Consequently, millions of tons of coal are rejected into tailings ponds each year. The rejection of such large quantities of fines results in environmental, aesthetic, and economic problems. Effective processing of fines will not only reduce these problems, but will also increase labor productivity and generate additional income from the sale of fine coal.

During this project, a laboratory-scale filter press previously developed by the Illinois State Geological Survey with funds provided by the Illinois Department of Commerce and Economic Opportunity through the Illinois Clean Coal Institute was tested for its ability to dewater fine coal using chemical dewatering agents to optimize performance. The fine coal tested was obtained from a flotation cell in the fine coal circuit of a coal processing plant in Illinois. Ongoing experimental results were used to make improvements in the design of the filtration system to enhance its efficacy.

The prototype device was tested in dewatering cleaned coal slurries using different solid/liquid ratios. The operating conditions were varied and the interactive impacts of various operating parameters on the moisture content of the filter cake were determined. These experiments were conducted with and without the addition of chemical dewatering agents formulated by the Principal Investigator. Several dewatering agents were tested both in the press and in a table-top vacuum filtration system to determine the most efficacious reagents. It was found that non-ionic surfactants with an HLB of 11 were the most effective. Using this dewatering agent and the unique tapping mechanism of the ISGS Intelligent Filter Press, the researchers were able to reduce the moisture content of a standard 1kg filter cake to 16% while increasing the cake size by as much as 300%.

In addition to the planned testing, several demonstrations of the laboratory filter press were conducted during the project period. These demonstrations strengthened industry interest and prompted requests for field demonstrations. Using numerous test results, the project team completed various design improvements collecting information needed to begin engineering and design of a larger filter press. Industrial Technology Group's (ITG) Champaign office was contracted to do the preliminary design of an industrial-scale model. With the ICCI's approval, all remaining project funds were allocated towards purchasing major components for a larger system. As of November 30, 2003, the project completion date, a complete hydraulic system including power pack and two 14-inch cylinders, an air compressor and a feed pump have been purchased and received. The PI is working with ITG on final design of the filtration chamber and plates and a frame for the entire system. Additional funding is being sought to complete purchasing, assembly and testing of the new unit.

Development of the industrial-scale filter press is an integral part of the total ISGS fine coal processing package. Successful scale-up of the ISGS Intelligent Filter Press will allow Illinois coal operations to utilize the ISGS Washer, which is also ready for demonstration on an industrial scale. These two technologies combined enable cleaning of the ultra-fine coal product presently discarded at most operations, which in turn will generate additional revenue for mines, reduce production costs of saleable coal and power, and produce a cleaner product with fewer environmental implications.

The remainder of this report contains propriety information and is not available for distribution except to the sponsor(s) of this project.