ABSTRACT

The ISGS has been developing new technologies for recovering and cleaning fine coal typically discarded as waste by most mining operations in the State of Illinois. One of the major challenges in doing this is that fine clean coal product is a slurry that must be sufficiently dewatered to be marketable. To meet this challenge, the ISGS research team developed the Intelligent Filter Press (IFP). With ICCI funding, a laboratory prototype was built and tested. Results suggested scale-up to a more commercially viable size and additional funds were allocated to procure most of the necessary components for a large press with a capacity of 1 ton per hour. The goal of this project was to assemble and test the larger IFP in the laboratory and then conduct a field demonstration in conjunction with other research on fine coal processing equipment being developed at the ISGS.

The IFP competes with screen and solid bowl centrifuges, belt presses, disk filters and other frame plate filter presses in the fine coal dewatering arena. Achieving a product at or below 20% moisture is considered a success. The IFP accomplishes this using a unique proprietary concept that is being patented. This testing program was to ensure that the commercial scale version of the automated IFP could consistently produce a relatively dry filter cake with minimal supervision and maintenance.

Early in the project period, it became clear that space and equipment constraints would not allow assembly of the IFP as planned at the facilities of Dynamic Separations Inc. (DSI), owners of the license to this technology. The proposed work was put on hold while DSI and the ISGS completed field demonstrations of the Motorless-Rotorless Cell (MRC) and the Inclined Froth Washer (IFW). At the conclusion of these field tests, when there was no interest on the part of the mine operators at the demonstration sites to host a demonstration of the IFP, and a suitable location for assembling and testing the IFP could not be found in the Champaign, Illinois area, the project was terminated. A separate project has been funded to do this work at the Illinois Coal Development Park operated by Southern Illinois University in Carterville, Illinois.
EXECUTIVE SUMMARY

Fine-grained coal results from the mining, handling and processing of this important energy resource. On average, about 25% of all the coal mined in Illinois is lost during processing because equipment which can effectively and economically process, recover and dewater the fine coal is not available. Disposal of this fine coal in tailings ponds not only wastes product that cost money to mine, it adds to the total production costs by requiring impoundments and their associated permitting and reclamation costs.

Successful recovery of fine coal from incombustible mineral impurities results in a clean, high quality product. However, since the cleaning medium is usually water and fine coal particles have much more surface area than coarse particles, the resulting product is high in moisture content. Economic studies suggest that the coal industry in Illinois stands to benefit significantly if technology can be developed to recover and dewater this valuable resource that is currently being disposed of as waste. This project was designed to address that issue by advancing a state-of-the-art filtration technology developed at the ISGS towards commercialization. The technology also has merit in the utility industry where it can be used to dewater scrubber fly ash slurries.

The Intelligent Filter Press (IFP) designed by the Principal Investigator and colleagues at the ISGS is a very simple filtration device. It uses a filter plate advanced by a hydraulic piston through a cylindrical filtration chamber to displace liquids from solids in a fine coal slurry fed into the chamber. Air is then blown into the chamber to further purge water from spaces between solid particles. Finally, a unique proprietary function of the system helps re-arrange particles in the filter cake to generate a more compact cake with the least amount of water. A patent is being sought on the unique aspect of the IFP. The IFP is fully automated to ensure unsupervised, continuous operation.

After testing the IFP concept on a laboratory scale, a large-diameter filter press was designed and components fabricated with funds provided by the Illinois Department of Commerce and Economic Opportunity through the Illinois Clean Coal Institute. This field scale model is designed to process up to 1 ton per hour while remaining small enough to be transportable in total on a standard flatbed trailer. The purpose of this project was to assemble the larger IFP and test it under laboratory conditions to ensure that all systems and components fit together and function properly. The filter press would then be transported to a field site to evaluate its ability to dewater fine coal under sustained operating conditions. This testing would include measuring impacts of various operating parameters on moisture content of the filter cake in order to determine optimum operating parameters. During field testing, it was anticipated that changes in the design of the filter press may be required for its adoption by industry and to achieve better performance. This project was also to be used to determine the final design of a versatile industrial unit.

In the fall of 2003, a venture capital group called MHI Energy Partners, LLC obtained the exclusive license for the IFP along with other fine coal technologies being developed by the ISGS. One year later they formed Dynamic Separations Inc. (DSI) to continue
development of the ISGS technologies with a specific emphasis on commercialization. Components for the large-diameter IFP were moved to DSI’s shop in Champaign, Illinois for assembly and testing. However, lack of heavy lifting equipment and an uneven floor at the shop presented safety concerns that prevented this work from being done. It was decided that the filter press should be assembled in the field and the project was placed on hold while two other field demonstrations of ISGS fine coal cleaning technologies were completed at different mines in Illinois.

One of these demonstrations took place at the mine initially slated for hosting the IFP demonstration. That demonstration was successful enough that the mine decided their need for dewatering technology was immediate and they began looking at commercially available equipment with a proven track record. This forced the ISGS research team to look elsewhere for a demonstration site. When one could not be found by the end of the project period, the project was terminated. Still wanting to see the large-diameter IFP assembled and tested for functionality, the Illinois Clean Coal Institute instigated discussions between the ISGS and Southern Illinois University at Carbondale, Illinois (SIUC). An agreement was worked out to do the work at the high bay laboratory of SIUC’s Illinois Coal Development Park and a separate project has been funded by the Illinois Clean Coal Institute to accomplish this work.