

FINAL TECHNICAL REPORT
April 1, 2001, through July 31, 2002

Project Title: **TESTING OF THE ISGS WASHER ON A 100 CUBIC FOOT
SUBAERATION CELL TO RECOVER FINE COAL**

ICCI Project Number: 00-1/4.1C-1R
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ABSTRACT

The purpose of this project was 1) to scale-up the pilot plant (1.3 ft³) version of the inclined washer and subaeration cell system developed at the Illinois State Geological Survey (ISGS) over the past four years with support from the Illinois Clean Coal Institute and the US Department of Energy (US DOE) to an industrial size (100 ft³) unit and 2) to test and debug the scaled-up unit under industrial conditions on processing fine refuse.

This was the fourth year of development of the washer from proof of concept to an industrial scale version on commonly used subaeration cells. The pilot plant version of the inclined washer (ISGS washer) has been successfully tested under continuous conditions on a subaeration cell. As in the subaeration flotation cell, much better sulfur rejections have been achieved in flotation columns equipped with the washer. The goal of this exercise was to find the limits of its tolerance and to see what adjustments can be made in the subaeration cell to extend those limits. The mine where this unit was being tested provided ample challenges and hence opportunities to test the limits.

The manufacturer of the subaeration cell and a foreign flotation reagent company participated in this exercise. To make the system more flexible and to enable it to deal with a variety of problems that may arise in an industrial environment, an understanding on the need for modifications both in the design of washer as well as of the subaeration cell has been reached.

EXECUTIVE SUMMARY

Illinois coal mines have been closing steadily because they cannot produce coal that is cleaner and cheaper than their competitors. The coal produced is not of the desired quality because the processing methods used to upgrade coal to marketable products have failed to generate a marketable product at a reasonable cost. Both the inefficiency of the processing methods used and the capital and operating costs of the cleaning methods required to clean the coal thoroughly have been responsible for this dilemma. This predicament has encouraged the coal producers in Illinois to recover the easily cleanable coal from the mined-out material, and to discard the rest with the result that on the average, about 25% of the coal that is mined in Illinois is rejected. Consequently, millions of tons of coal are rejected into tailings ponds. The rejection of such large quantities of fines results in environmental, aesthetic, and economic problems. Money generated from sale of the easily cleaned coal is spent to dispose of material on which capital has been spent to mine it, and some of which has the potential to generate an exceptionally clean product, if properly processed. This rejected coal increases the cost of production instead of augmenting the revenues, besides causing environmental hazards.

A device that can help existing processing equipment produce cleaner coal at a faster rate will reduce the number of flotation machines required to process a given tonnage of the material. A washer was developed at the ISGS with financial support from the ICCI to solve this problem. Under optimum conditions the performance of flotation devices equipped with the ISGS washer surpasses the best performance of any flotation device, as measured by Advanced Flotation Release analysis. It also increases the throughput rates of the flotation devices to which it is attached.

Successful development of the inclined washer can decrease both the capital and operating costs of froth flotation because the washer is specifically designed to increase the throughput of a flotation cell. In a fine coal-recovery plant, the flotation circuit is the largest expense, generally more than one half of the total. The inclined washer can increase the throughput of a given flotation machine and consequently decrease the initial capital cost. Several operating expenses will decrease as well. However, the information required to estimate these expenses is currently not available although it has been established that a subaeration cell requires less reagent than a packed column (approximately one half the frother). So far, it appears that the reagent consumption of an industrial-scale subaeration cell equipped with inclined washer will be approximately the same as a standard subaeration cell. Also when cleaner coal (and consequently a more concentrated tail) is produced, both the operating and capital costs will decrease. The volume of tails will decrease leading to decreased cost of disposal, and more coal will be recovered leading to increased profit from the operation.

Through the development of the inclined washer, decreased costs of recovering coal from fines will come at a time when coal processing plants handle increasingly larger quantities of fine-grained materials generated either during mining, transportation, or processing, and when the Illinois mines are steadily closing because they cannot produce a cleaner product economically.

This device has the potential to eliminate the need for multistage cleaning steps, economically enlarge the capacity of the existing coal washing plants and produce a premium product from the tailings. It could reduce the costs of processing fines in coal preparation plants, help processing of fine coal recovery become a more common practice, and enable the operator to produce a cleaner coal more cheaply. It could also reduce the costs of disposal of the rejected fines, minimize disturbance of land, cut the reclamation cost, alleviate the environmental hazards, and improve the aesthetic value of the land involved.

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