FINAL TECHNICAL REPORT
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Project Title: **FILTRATION OF CONCENTRATES FROM THE ISGS WASHER**


ICCI Project Number: 01-1/4.1A-1
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## ABSTRACT


A filtration system is needed to effectively dewater fine-grained coal that has been cleaned in a subaeration cell equipped with an ISGS Washer. Excessive moisture will not only diminish the heating value of the coal, but it also makes the coal difficult to handle and transport. Effective removal of water from coal is required to generate a marketable product. The goal of this project was to conduct preliminary tests designed to evaluate the efficacy and design of an automated, prototype filter press with a unique approach that will help result in a compact filter cake with minimal moisture content. The ISGS Intelligent Filter Press was built at the Illinois State Geological Survey from a conceptual design without bench- or pilot plant-scale testing. This specific design of this filter press is currently propriety.

The results of this project were based on dry maiden tests of the automation system, water-only trials, pressurization experiments to test safety features, and lastly the testing of the filter press to reduce the moisture content of coal slurry generated in a subaeration flotation cell equipped with an ISGS Washer. The results of the preliminary tests revealed weaknesses in the design of the filter press which were resolved by design revisions and subsequent testing. Moreover, crucial safety features were incorporated into the design and operation of the filter press. It was concluded that the ISGS Intelligent Filter Press can effectively dewater fine-grained coal. However, further research is needed to optimize the filtration rate.


**Pages 1-31 contain propriety information**

# EXECUTIVE SUMMARY

Coal is an amorphous mass, with disseminated crystalline mineral impurities mostly distributed finely throughout the coal matrix. Liberation of the fine-grained impurities increases with a decrease in coal particle size. These fine-size particles, with a large specific surface area are difficult to clean and also difficult to dewater. Success in fine-coal cleaning is limited partially because of the limitations of existing equipment. Because of these limitations, rejection and impounding of fine coal at the washing plant is a common practice. Disposal of this fine coal in tailing ponds not only wastes material on which capital was spent in mining, but also such disposal contributes to disruption of land, and increases maintenance and reclamation costs.

Successful processing of these finely crushed coal particles in flotation devices equipped with the ISGS Washer results in a cleaner product. In the future, the coal mining industry will benefit by increasing its ability to process fines and to generate products that meet the requirements of environmental acceptability. The marketability of the cleaned moist coal in an economical manner is an issue that still needs to be resolved. The proposed project addresses this issue by recommending a state-of-the-art filtration method to dewater the deep-cleaned coal.

The ISGS inclined washer can make a single flotation cell produce a cleaner coal than that produced by a flotation column, but at the throughput rate of a common subaeration cell. This device allows an improvement over the more traditional system of subaeration cell batteries in which the froth or tails have to be re-cleaned to generate a product of the desired quality. Equipped with this device, each cell can produce the final product in a single run, leading to increased capacity of the plant or a decrease in the number of the cells required to process a given quantity of feed material. The result is a considerable savings in installation and/or operational cost. Costs will also be reduced because of greater efficiency in cleaning the fines and because of the reduced costs for the disposal of fines. Still these savings cannot be realized if the deep cleaned coal cannot not be de-watered to improve its heating value and handling.

Development of an effective filtration system goes hand-in-hand with the development of the ISGS Washer. Successful development and adoption of the inclined washer should 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 cost. 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 full potential of the ISGS Washer cannot be realized by the coal industry if there is not an equally effective filtration system available to dewater the product and enhance its heating value.

Our data indicate that the inclined washer is especially effective in rejecting pyrite. 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 large quantities

of fine-grained materials generated either during mining, transportation, or processing, and when the Illinois mines are steadily closing because they cannot economically produce a cleaner product. On the average, about 25% of all the coal produced is lost during processing because of the lack of equipment which can effectively and economically process the coal. The losses are further intensified by the presence of clay minerals that render an effective cleaning of the coal impractical. 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. Effective processing of these fines will not only reduce these problems, but also help generate additional income from the sale of the fine coal.

A proto-type filtration unit was tested on the dewatering of a product generated from fine coal in a flotation system. The objective was to create a fine coal product suitable for shipment to consumers. Based on the results of these tests, improvement in the filtration system can be made to enhance its efficacy.

The Filtration unit was tested on the dewatering of the deep-cleaned coal produced. Data gathered during these tests helped in the design of an automated, reliable, effective, and safe filtration unit. Almost all the mines in Illinois will benefit from this technology because it can help them utilize the potential of the ISGS Washer to generate extra revenue, reduce the cost of production, and help produce a cleaner product.

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