The Electric Power Research Institute (EPRI) agreed early in 1988 to test an ISGS/SIU-C proprietary reagent package against the conventional coal flotation reagents, methylisobutyl carbinol and No. 2 fuel oil, at a 0.5 ton/hour coal feed rate in its Coal Quality Test Facility at Homer City, Pennsylvania. The tests were made April 11 through April 14, 1988. EPRI covered the cost of running the tests and the cost of analyses. Funding for acquisition of the reagents was provided by the Center for Research on Sulfur in Coal under this contract. ISGS staff members delivered the reagents to Homer City, and stayed to observe and select reagent dosages for the tests with the ISGS/SIU-C reagent package. Coal for the tests was Illinois Herrin (No. 6) coal from the Burning Star #4 mine. It was provided by Consolidation Coal Company.

Two size consists of feed coal were tested -- minus 100 mesh by zero and minus 325 mesh by zero. For the coarser size distribution a set of four WEMCO, sub-aeration, flotation cells which are a permanent part of EPRI's facility were used. For the minus 325 mesh sample three column flotation cells (Bergbau-Forschung) connected in series were used. The latter remained from a temporary installation made last year by Bechtel National with U. S. Department of Energy funding.

Analytical results determined by EPRI contractors for the products have been available to the ISGS since August 12. These are being compared to analyses of samples the ISGS obtained for independent checks of the analyses. The agreement amongst the parties (EPRI, ISGS and SIU-C) calls for discussion of results before releasing reports to the public. That discussion is underway.
EXECUTIVE SUMMARY

The Illinois State Geological Survey, in conjunction with researchers at Southern Illinois University and Northwestern University, has been developing an advanced fine coal-cleaning technology, Aggregate Flotation (AF). It has been shown that the process which utilizes selective reagents in combination with ultrafine grinding to liberate pyrite and other mineral matter is quite effective.

A number of other advanced physical fine coal cleaning processes have recently emerged. Most approaches involve new cell designs. These new cells include the Static Tube Packed Column (Michigan Tech), Reverse Column Flotation Method (United Coal Company in conjunction with the Diester Company), Microbubble Column Flotation (Virginia Tech) and the Bechtel Microbubble Process (Bergbau-Forschung). Those cited generally use commercial frothing alcohols, such as MIBC (methylisobutyl carbinol), in conjunction with a collector such as No. 2 fuel oil. While these new cell designs do possess merit, their biggest disadvantage is the retrofitting of currently existing plants that will be required to accommodate such designs. An alternative to the new equipment design is new reagent packages which can be effective in conventional cells.

Restrictions in achieving good separations of ash and pyrite from ultrafine coal have been minimized in the ISGS approach by using "chemically selective" reagents. By taking advantage of differences in surface properties of coal, mineral matter and pyrite, and by applying principles based on coal surface chemistry/reagent composition to solve the problem of poor separations, and recovery, ISGS workers have, for some coals, attained up to 90% removal of pyrite while retaining up to 90% of the Btu from the original coal. A significant advantage claimed for the AF process is that the "chemically" selective reagents are used without a specific "new" cell design being required. The reagents developed have heretofore been tested primarily in conventional sub-aeration (Denver) units but they are believed to have application in the advanced cells currently being developed. Thus, the opportunity to verify the ISGS concept in another type of cell was welcomed.

Bechtel National, Inc. recently completed evaluating its Microbubble Process in the EPRI Coal Quality Test Facility at the proof of concept level (1 ton/hr) under the DOE/EPRI co-funded project entitled, "Advanced Physical Fine Coal Cleaning". Conventional coal flotation reagents, methylisobutyl carbinol and kerosene, were used as the flotation reagents. Because of manufacturing delays, a sufficient quantity of the best ISGS/SIU-C reagent package was not available for consideration by Bechtel during its contract period. Later, after the contract expired, discussions with EPRI resulted in the current tests under a new contract at a time when EPRI's goal was the determination of reagent packages on coarser coal (minus 100 mesh by zero) rather than the ultrafine coal (<20 microns) used for the Bechtel studies. EPRI staff deserve commendation for their flexibility in including two days of tests with -325 mesh by zero coal which was outside EPRI's primary goals. The work was possible because the fine grinding equipment and the column cells belonging to the Department of Energy had not yet removed from the facility.
No effort has been made at the ISGS to float 100 mesh x zero coal with the reagent package shown to be superior for ultrafine coal. Extrapolation of trends with smaller size consists would predict poor performance. Preliminary batch tests were made with coal from the Burning Star mine #4 ground to approximately 80% passing 400 mesh to assist in picking dosages for the Homer City tests. These tests indicated that the dose of the proprietary ISGS/SIU-C reagent package required to achieve a given ash and sulfur rejection and coal recovery was no more than one half the dose required of the conventional reagents.

The first set of comparative tests was made with 100 mesh by zero coal in the set of four WEMCO, sub-aeration, flotation cells which are a permanent part of EPRI’s facility. These cells are arranged in two sets of two hog-trough cells divided by a weir. The bank of three column flotation cells was a series arrangement with the tailings or underflow from one cell going to the next cell.

Representative fractions of several of the same product samples saved for analysis by the EPRI contractor were brought to Champaign by ISGS staff to give independent checks on results. The agreement amongst the parties holding rights to the chemical package (ISGS and SIU-C) and the EPRI specifies the manner in which results can be made public. Available data have been made available to the CRSC Project Monitor but public announcements must be preceded by discussions of results and their interpretation and conclusions reached. These discussions are underway and at their conclusion, EPRI and the Illinois parties will release reports.