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TECHNICAL REPORT
September 1, 1995, through November 30, 1995

Project Title: **IN-PLANT TESTING OF A NOVEL COAL CLEANING CIRCUIT USING ADVANCED TECHNOLOGIES**

DOE Cooperative Agreement Number: DE-FC22-92PC92521 (Year 4)
ICCI Project Number: 95-1/1.1A-1P
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ABSTRACT

Research conducted at SIUC over the past two years has identified highly efficient methods for treating fine coal (i.e., -28 mesh). A circuit utilizing hindered-bed classifiers, enhanced gravity concentrators and column flotation has been found in a previous ICCI project to provide a highly efficient cleaning of fine coal in which both ash and total sulfur contents are significantly reduced while maximizing the recovery of coal. In this study, a circuit comprised of the three technologies will be tested in an operating preparation plant to evaluate circuit performance and to compare the performance with the current technologies used to treat fine coal.

Prior to the in-plant testing, the effect of changing feed characteristics on the performance of the enhanced gravity concentrator (i.e., Falcon) was evaluated for process control purposes. During this reporting period, a -16 mesh Illinois No. 6 coal sample containing about 30% ash and 8.0% total sulfur was collected from a refuse pond. The ash and total sulfur contents of the sample were depleted by withdrawing a controlled amount of tailings produced by the C10 Falcon unit to determine the effect of changing feed compositions. It was found that higher combustible recovery values are achieved when the feed ash content is decreased and slightly lower product sulfur content values are obtained when the pyritic sulfur content in the feed is decreased. The lower total sulfur contents are most likely due to the natural by-pass to the product stream of 5 - 10% of the heavy particles. In other words, an increase in the feed sulfur content results in an incremental increase in the sulfur content of the product. The higher combustible recovery values obtained with decreasing feed ash contents are likely due to a reduction in the amount of entrapped coal particles within the bed of heavy-particles formed contiguous to the bowl wall in the Falcon unit. Higher bowl speeds and adjustment of the tailings rate have been found to counter the negative effects caused by the increase in feed ash and total sulfur contents.

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EXECUTIVE SUMMARY

The goal of this project is to demonstrate through in-plant testing the improved separation performance and enhanced economics that may be provided by a fine coal cleaning circuit utilizing advanced coal cleaning devices. In addition, it is also a goal to develop a precombustion coal cleaning strategy for the production of Phase I and II compliance coal from medium-to-high sulfur Illinois Basin coals.

The fine size fraction (i.e., -28 mesh) in U. S. coal preparation plants has been given very little attention until recently. However, the production of larger amounts of fines by the increase in mine mechanization and the fact that the fine coal fraction contains the most pure coal particles in the preparation plant has created a great deal of interest in the efficient cleaning and recovery of fine coal. Several technologies have been developed and introduced to the coal industry which assist the plant operators in achieving this task. The modifications to the original spiral concentrators to treat fine coal have resulted in their recent popularity among coal producers. However, despite the units simplicity of operation, several problems exist related to their separation performance capabilities and operational/maintenance characteristics. For example, their relatively small throughput per unit (i.e., 3 tph) requires the need for a large number of units to treat a moderate size stream and, thus, a complex distribution system that often gets plugged during operation. In addition, the specific gravity cut point provided by the spiral is a relatively high 1.8 and, despite extensive efforts, has yet to be decreased. Conventional flotation is another technology commonly used to treat fine coal but also has problems with the entrainment of clay particles in the clean coal concentrate and its ineffectiveness at cleaning coals containing a significant amount of middling particles.

Tests conducted over the past two years as part of ICCI projects have identified fine coal cleaning technologies that appear to provide an improved separation performance when compared to technologies currently being used in the coal industry. The research projects evaluated three distinctly different solid-solid separation technologies, namely, hindered-bed classification, enhanced gravity concentration, and column flotation, which were found to be highly efficient for treating ranges of particle sizes that are compatible when placed in a circuit arrangement. The hindered-bed classifier, commercially known as the Floatex, was found to be the most effective on the 16 x 48 mesh size fraction. The specific gravity-cut point provided by the unit is about 1.8 while achieving a probable error value (E_p) of 0.12, which is an improvement in efficiency over spiral concentrators which yield a E_p of 0.12 to 0.20. In addition, the unit is able to treat much larger throughputs, thereby, eliminating the need for a complex feed distribution system. The operating parameters of the Floatex can be easily adjusted by a controller, which is not currently possible for spiral concentrators.

The Falcon Concentrator, an enhanced gravity concentrator, was found to be the most efficient at treating the 48 x 400 mesh coal size fraction. The specific gravity cut point was found to be easily varied by the adjustment of operating variables to achieve values between 1.5 and 1.7, which are less than those achievable by spiral concentrators. The E_p

value obtained from the Falcon unit was approximately 0.12. Pyritic sulfur rejections greater than 75% were achieved while maintaining recovery values at near or greater than 90%.

A number of studies comparing the performance of column flotation with conventional flotation, which is presently the most common process used for treating the -100 mesh size fraction, has found that column flotation is more efficient in the recovery of ultrafine particles and produces much lower product ash contents. In an ICCI study, recovery values greater than 90% were achieved by number of different flotation column units while reducing the ash contents of Illinois Basin coal containing 60% -325 mesh material from as high as 50% to below 5%. These results demonstrate the excellent desliming efficiency of flotation columns. The Jameson Cell was found to be very attractive due to its high throughput and operational simplicity. The cell is self-aspirating, using a venturi-based system to draw air into a long tube where the bubbles are intimately mixed with the coal particles. The only requirement for the system is a feed pressure of approximately 20 psi.

In this project, fine coal circuit comprised of the three aforementioned advanced coal cleaning technologies will be tested in an operating coal preparation plant for the purposes of improving the efficiency of current preparation plant operations and developing a Phase II compliance strategy for medium-to-high sulfur coal. To meet this goal, the specific project objectives must be realized, which are: 1) To install a fine coal cleaning circuit having a mass flow capacity of approximately 5 tph at Kerr-McGee's Galatia preparation plant; 2) To test the circuit in a "real-life" environment while varying the operating conditions of the various units; 3) To compare the separation performance achieved by the circuit with the performance obtained by the circuit presently used for the treatment of the same size fraction; 4) To determine the economic benefits of the proposed circuit when compared to current circuits used to treat the same size fraction and 5) To produce Phase II compliance coal through the micronization and retreatment of the clean coal product from the proposed circuit. In addition to the above objectives, an on-line coal analyzer, commercially known as the AMDEL system, will be evaluated in an effort to study the effects of the operating parameters and to demonstrate its use as an effective control device. The on-line analyzer has the ability to analyze the ash content, air content, and solids content of a coal slurry with a total analysis time of 1 minute.

The circuit, which will be comprised of an 18 x 18 in^2 Floatex, a 10-inch diameter Falcon Concentrator, and a Jameson Cell, will be installed at Kerr-McGee's Galatia preparation plant and will have a mass throughput capacity of 5 tons/hr. The circuit will treat the 16 mesh x 0 size fraction that is currently cleaned by a combination of spiral concentrators (16 x 100 mesh size fraction) and conventional flotation (-100 mesh size fraction). Operating parameter values of the different units will be varied and samples collected from the product streams of the individual units and the overall circuit. Ash content, pyritic and total sulfur contents, BTU contents and washability analyses will be performed on the samples. Samples will also be collected from the circuit product streams currently in the plant to compare separation performances. The separation performance and economic viability of the proposed circuit will be compared with the existing circuit. The clean coal concentrate produced from the advanced fine coal circuit will be collected, micronized, and retreated in a Packed-flotation column and a Falcon concentrator in an effort to produce Phase II compliance coal. The clean coal product from this treatment will be given to ICCI as a potential feed stock for chemical/microbial processes.

During this reporting period, the effect of changing feed composition on the performance of the Falcon Concentrator was evaluated for control purposes. A nominally -16 mesh Illinois No. 6 seam coal sample containing about 30% ash and 8% total sulfur was collected from an inactive refuse pond. A wet screening analysis of the sample recovered approximately 61% by weight in the 16 x 100 mesh size fraction, 18% in the 100 x 400 mesh fraction and the remainder in the -400 mesh size fraction. During the tests, the Falcon unit was operated in closed-circuit, in which, the product and tailing streams were recycled to the feed sump. To study the affect of reducing the feed ash and total sulfur contents, the tailings stream was directed away from the feed sump for a pre-determined amount of time. All samples collected during the tests were wet screened using 100 and 400 mesh sieves and analyzed for ash and total sulfur content using ASTM procedures.

For the + 100 mesh size fraction, the ash content was reduced from 22.1% to 8.0% while recovering 82.7% of the combustible material. A further decrease in product ash content to 6.7% resulted in a sharp decrease in recovery to 42.0% After decreasing the feed ash content in this size fraction to 12.9%, the Falcon was able to reduce the ash content further to 6.3% while recovering 78% of the combustibles. Likewise, for the 100 x 400 mesh size fraction, about 5 - 10% improvement in combustible recovery was achieved at a given product ash content when the feed ash content was reduced from 31.6% to 24.0%. Visual observations made of the particle bed formed contiguous to the bowl wall inside the Falcon revealed a much thicker bed when a high ash content material being treated. Therefore, it can be postulated that the lower recovery values achieved as the feed ash content is increased may be due to entrapment of coal particles in the high-ash content particle bed formed next to the bowl wall.

Products containing a slightly lower total sulfur content were obtained when the feed sulfur content was decreased. For example, the sulfur content in the 16 x 100 mesh size fraction was reduced from 7.80% to 2.64% while recovering 82.7% of the combustible material. After decreasing the feed total sulfur content to 5.00%, the Falcon unit reduced the sulfur content to about 2.52% at nearly the same recovery value. This improved sulfur reduction is most likely due to the natural by-pass of heavy particles that is inherent of the Falcon Concentrator. Past studies by the principal investigator has revealed that 5 - 10% of the heavy particle are by-passed to the concentrate, most likely due to insufficient centrifugal force or hindered-settling toward the bowl wall. Increasing the applied centrifugal force from the 93 *g*'s used to obtain these test results to 150 *g*'s has been found to reduce the amount of by-pass.

Work during the upcoming reporting period will concentrate on the installation and testing of the AMDEL control system in the Illinois Coal Development Park. In addition, the circuit components will be ordered, transferred and installed in Kerr-McGee's Galatia preparation plant.

OBJECTIVES

The goal of this project is to demonstrate through in-plant testing the improved separation performance and enhanced economics that may be provided by a fine coal cleaning circuit utilizing advanced coal cleaning devices. To meet this goal, the specific project objectives must be realized, which are:

1. To install a fine coal cleaning circuit having a mass flow capacity of approximately 5 tph at Kerr-McGee's Galatia preparation plant,

2. To test the circuit in a "real-life" environment while varying the operating conditions of the various units,

3. To compare the separation performance achieved by the circuit with the performance obtained by the circuit presently used for the treatment of the same size fraction,

4. To determine the economic benefits of the proposed circuit when compared to current circuits used to treat the same size fraction.

5. To produce Phase II compliance coal through the micronization and retreatment of the clean coal product from the proposed circuit.

In addition to the above objectives, an on-line coal analyzer, commercially known as the AMDEL system, will be used in an effort to study the effects of the operating parameters and to demonstrate its use as an effective control device. The on-line analyzer has the ability to analyze the ash content, air content, and solids content of a coal slurry with a total analysis time of 1 minute. This response time is a large improvement over existing systems which require 15 to 20 minutes for de-aeration.

INTRODUCTION AND BACKGROUND

In this study, in-plant circuitry testing will be conducted which will incorporate advanced coal cleaning technologies that have been successfully evaluated over the past two years at SIUC. It is believed that the implementation of these technologies will result in a more efficient fine coal cleaning circuit, a reduction in floor space requirements, and an overall simplified operation that is easily adaptable to automation. A description of each technology and a summary of pertinent separation performance data produced from each unit is provided in the following sections.

Floatex Hydrosizer

The Floatex hydrosizer is a hindered-bed classifier which utilizes elutriation water added in the bottom of the cell to suspend the particles entering in the feed, thereby, creating a fluidized bed. Heavy particles pass through the fluidized bed toward an underflow discharge while the light particles are pushed out the top by the velocity of the upward flow of water. A pressure transducer is used to monitor and control the bed density by manipulation of an underflow control valve.

Tests results from a 9 x 9 in^2 Floatex revealed that the unit could effectively treat the 16 x 65 mesh size fraction of an Illinois No. 5 coal sample. The product ash and total sulfur contents were reduced from 20% to 8% and 2.23% to 1.49%, respectively, while recovering 95% of the combustibles at a mass throughput of 1.2 tph/ft^2. The tailings ash and total sulfur content was 79.8% and 6.28%, respectively. A summary of these results are provided in Table 1.

Washability analyses of 16 x 100 mesh product and feed samples from the test providing the results in Table 1 resulted in the partition curve shown in Figure 1. The partition curve indicates that the Floatex provides a sharp separation at a specific gravity of approximately 1.8 for the treatment of 16 x 100 mesh coal. The probable error value (E_p) determined from the partition curve is 0.12, indicating a more efficient process than spiral concentrators which have E_p values between 0.12 and 0.20.

Table 1. Results obtained from the treatment of 16 x 100 mesh Illinois No. 5 coal collected from the Galatia Preparation Plant using a 9 x 9 in^2 Floatex hydrosizer. The mass feed rate was 1.2 tph/ft^2.

Size Fraction	Weight (%)		Ash (%)		Total Sulfur (%)	
	Feed	Product	Feed	Product	Feed	Product
+16	18.6	10.9	18.0	4.50	1.67	1.34
16 x 28	21.8	22.0	21.1	5.44	2.02	1.42
28 x 48	23.7	25.7	20.7	6.84	2.65	1.48
48 x 65	8.5	9.8	16.8	10.4	2.41	1.61
65 x 100	6.6	7.6	23.0	18.5	2.80	1.78
-100	20.9	24.0	41.6	38.9	3.19	2.73

As part of a previous ICCI project, in-plant testing of an 18 x 18 in^2 Floatex unit was performed at the Galatia Preparation plant on spiral concentrator feed which is nominally 16 x 100 mesh. The results obtained from these tests agree with those from the smaller unit in that the Floatex provides an efficient separation performance for the 16 x 100 mesh size fraction. In fact, the Floatex results were found to be superior to those achieved by the spiral concentrators as shown in Table 2.

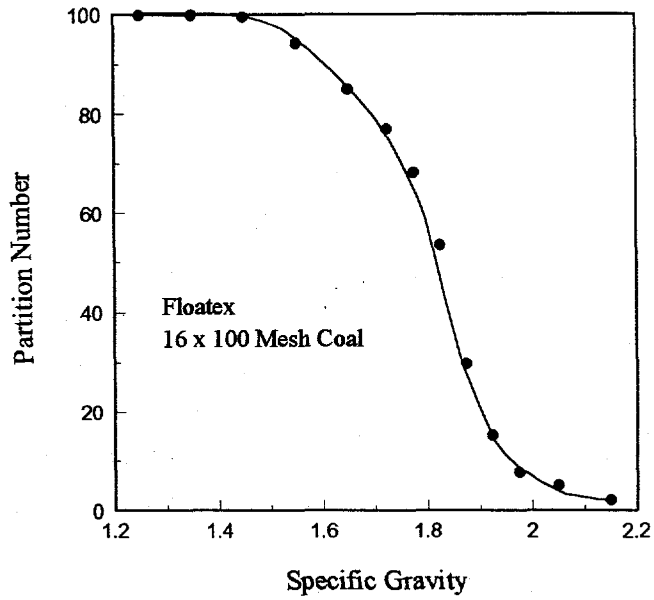


Figure 1. The partition curve produced by the Floatex hydrosizer from the treatment of nominally 16 x 100 mesh Illinois No. 5 coal. Mass throughput was 1.2 tph/ft^2 at a feed solids concentration of 35% by weight.

Table 2. Results obtained from the in-plant testing of an 18 x 18 in^2 Floatex at the Galatia Preparation Plant.

Test Number	Ash (%) Feed	Ash (%) Product	Ash (%) Tailings	Total Sulfur (%) Feed	Total Sulfur (%) Product	Total Sulfur (%) Tailings	Yield (%)
Floatex							
1	23.2	8.46	79.3	2.43	1.70	4.48	79.2
2	20.6	9.59	66.4	2.29	1.66	4.70	80.6
3	19.4	8.70	72.7	----	----	----	83.3
4*	20.8	7.32	82.4	1.35	1.04	3.07	82.0
Spiral							
1	20.3	10.0	57.9	2.27	1.73	4.26	78.5
2	20.7	10.6	58.8	----	1.84	4.23	79.1
3	21.8	10.8	53.3	----	1.90	4.75	74.1

*low sulfur feed

Falcon Concentrator

The Falcon Concentrator is a spinning flowing film separator. The concentrator uses up to 300 *g*'s of centrifugal force to cause deposition and stratification of fine particles against the inside of the smooth centrifugal bowl wall. The feed enters in the bottom of the bowl where a rotor enhances the acceleration of the particles to the bowl wall. Due to the sloped wall (approx. 10^{0} from vertical), a force parallel to the wall pushes the bed of solids up the bowl. As the bed moves, the heavy particles migrate toward the bowl wall while the light particles move inward toward the center of the bowl. The bed of particles move along the bowl wall and across a 1/2- inch slot that exists around the circumference of the bowl. The heavies flow into the slot and are discharged through orifices. The light particles flow over top the slot and report to the overflow as the final product with the particles that remained dispersed in the feed water.

Research conducted over the past year has found that the Falcon Concentrator achieves an efficient separation on the 65 x 400 mesh coal size fraction. As shown by the partition curves in Figure 2(a), the specific gravity cut point can be ranged from 1.5 to 1.7 while achieving a probable error value of approximately 0.12. However, the Falcon unit is less effective on the 28 x 65 mesh size fraction for which the cut point is 1.8 or greater and the probable error value varies from 0.2 - 0.3 (Figure 2b), resembling values achieved by single stage water-only cyclones. Thus, the Floatex hydrosizer would be the preferred method for the treatment of the 28 x 65 mesh size fraction.

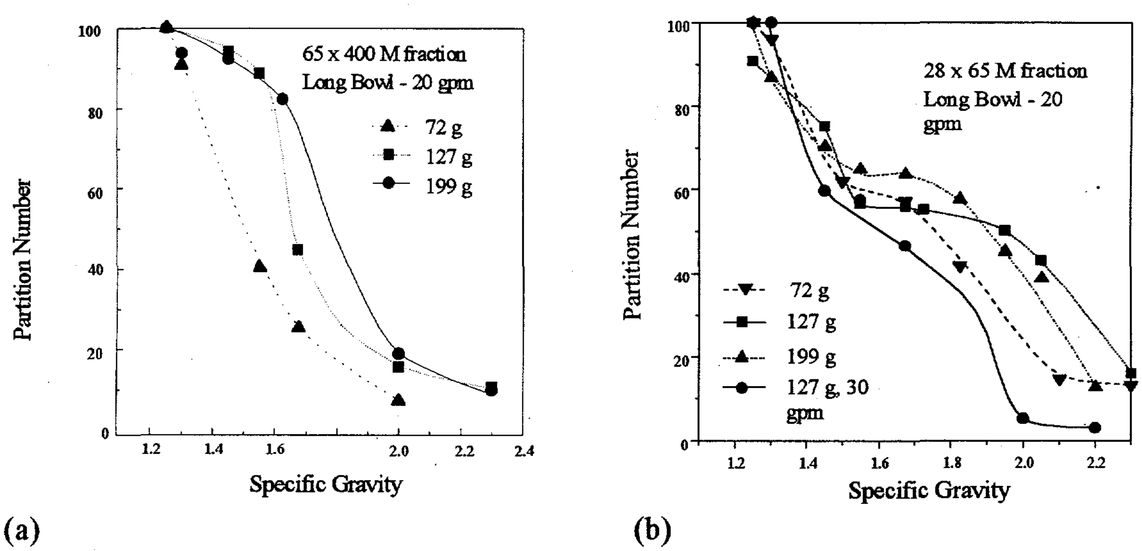


Figure 2. Partition curves produced from a continuous Falcon Concentrator from the treatment of nominally -28 mesh Illinois No. 5 seam coal. The products were screened to obtain the (a) 65 x 400 mesh and (b) 28 x 65 partition curves.

Mass feed rates and volumetric flows ranging from 1 to 4 tph and 10 to 40 gpm, respectively, were effectively treated by a 10-inch diameter continuous Falcon Concentrator. Typical size-by-size data provided in Table 3 illustrate the ability of the process to reject pyritic sulfur while maintaining high recovery values, even in the -325 mesh size fraction. It also indicates by the low calorific values the inability of the process to effectively de-ash the -325 mesh material. Thus, it is required to deslime the Falcon overflow using a hydrocyclone or a flotation column..

As part of a current project, a 40-inch diameter Falcon Concentrator will be tested at the Coal Research Center of Southern Illinois University. The unit will be fed coal slurry at a rate up to 2000 gpm to establish maximum capacity. A projected mass flow rate for this unit is 100 to 150 tph.

Table 3. Results obtained from the treatment of Illinois No. 5 coal using a continuous 10-inch diameter Falcon Concentrator. Volumetric feed rate was 20 gpm at a solids content of 16% by weight.

Test Number	Total Sulfur (%)		Product	Recovery	Total Sulfur	lb SO_2
	Product	Tailings	BTU/lb	(%)	Rej. (%)	per MBTU
+100	1.46		13,660			2.14
1	1.38	7.91	13,470	99.2	6.64	2.05
2	1.28	5.55	13,610	97.3	16.0	1.88
3	1.23	4.57	13,610	95.2	21.6	1.80
4	1.15	2.57	13,610	79.9	38.4	1.69
100 x 325	1.80		12,700			2.84
1	1.53	8.76	12,525	98.7	18.2	2.44
2	1.41	5.81	13,365	96.7	28.6	2.11
3	1.29	4.65	13,430	90.4	39.2	1.92
4	1.23	3.47	13,635	80.5	49.1	1.80
-325	1.73		5,830			5.93
1	1.44	7.86	5,855	98.5	20.5	4.92
2	1.38	6.80	6,175	97.4	25.4	4.47
3	1.32	4.99	6,220	93.5	36.0	4.25

<u>Column Flotation</u>

A research project funded by the Illinois Clean Coal Institute investigated and compared 6 different commercially-available flotation column technologies, namely, the Jameson Cell, the Packed-Column, the Microcel, the Flotaire, the Turbo-air, and the Canadian column. The last four are typical open columns that differ only by the method of bubble generation. The Packed-Column utilizes plates placed approximately 1/4-inch apart inside the cell to enhance the bubble-particle collision environment. The Jameson Cell is self-aspirating and, thus, does not require a sparging system. Air is drawn in through an opening behind an orifice through which the feed enters under a pressure of about 20 psi. The bubbles are formed in the presence of the coal particles, thereby, providing a high probability of bubble-particle collision

Although each of the flotation columns achieved a high separation efficiency for each of the coals tested in the investigation, the Jameson Cell was found to provide a high throughput capacity while requiring the least amount of support equipment. Basically, the only requirement is a pump or enough natural head to supply a feed pressure of approximately 20 psi. Another advantage for preparation plant operators is the low headroom requirement due to the lack of need for long residence times. Excellent separation performances were achieved by the Jameson Cell. For an Illinois No. 5 flotation feed, the ash content was reduced by the Jameson Cell from 44.0% to 4.21% while achieving a recovery of 85.3%. This corresponds to a very high separation efficiency of 81.9% for a single stage cleaning operation. In fact, the separation performance achieved by the Jameson Cell was found to be near to that obtained by the theoretically optimum release analysis curve as shown in Figure 3. For these reasons and due to its simplicity of operation, the Jameson Cell was chosen to be tested as part of the proposed fine coal circuit.

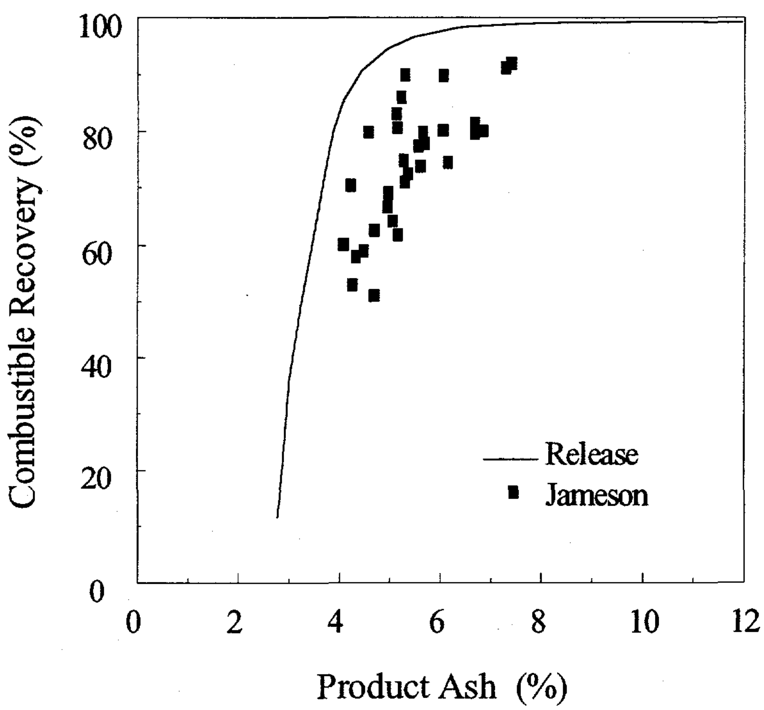


Figure 3. Results showing the separation performance achieved by the Jameson Cell from the treatment of nominally -100 mesh Illinois No. 5 coal.

Although, Jameson cell was found to be a high capacity flotation machine, it was found to be not as efficient a pyritic sulfur rejecter as the Packed-Column, which was concluded to be the most selective flotation technology in a recently completed project funded by ICCI. Unlike in the Packed Column, the bubble-particle attachment in the Jameson cell takes place in a down-comer, having a very high air-holdup of about 60%. Consequently, almost all the hydrophobic particles irrespective of their degrees of hydrophobicity get attached to the air-bubbles inside the down-comer. Because of a lesser reflux-action due to a shallow froth depth of the separating chamber of the Jameson cell, the weakly hydrophobic particles such as coal pyrites never get a chance to get selectively detached from the air bubbles and thus, get recovered to the product launder. As a result, the coal product from the aforementioned circuit is expected to contain a significant amount of pyritic sulfur. As in Illinois Coal, pyritic sulfur is known to be very finely disseminated, the coal product will be ground down to a size of -200 mesh and then treated in the Packed Column to produce a low sulfur coal to comply with the Phase II requirement of the Clean Air Act.

EXPERIMENTAL PROCEDURES

Sample

The sample used in the tests conducted during this reporting period was collected from an inactive coal refuse pond at CONSOL Inc's Burning Star No. 2 mine, which processed coal from the Illinois No. 6 coal seam. The sample, which was collected in dry form, was nominally -16 mesh and contained approximately 30% ash and 8% total sulfur. Results from a size-by-size analysis of the sample is provided in Table 4.

Table 4. Size-by-size analysis of the Illinois No. 6 refuse pond sample used for the tests in this study. Sample was collected in dry form.

Size Fraction (mesh)	Weight (%)	Ash (%)	Total Sulfur (%)	Pyritic Sulfur (%)
16 x 100	61.3	22.1	7.8	5.7
100 x 400	18.3	31.6	8.2	4.6
-400	20.4	66.6	----	----

Experimental

The tests in this report were conducted using the C10 Falcon concentrator which has a 10-inch diameter bowl with a 10° slope. The Falcon unit was operated in closed-circuit in which the product and tailing streams were directed to the feed sump. To test the affect of varying feed composition, the tailing stream was directed away from the feed sump for a pre-determined amount of time which resulted in a reduction in the feed ash and total sulfur contents. A test program which varied bowl speed, feed rate and tailings rate was performed for two feed compositions. The feed solids content was maintained at 14% by weight.

RESULTS AND DISCUSSION

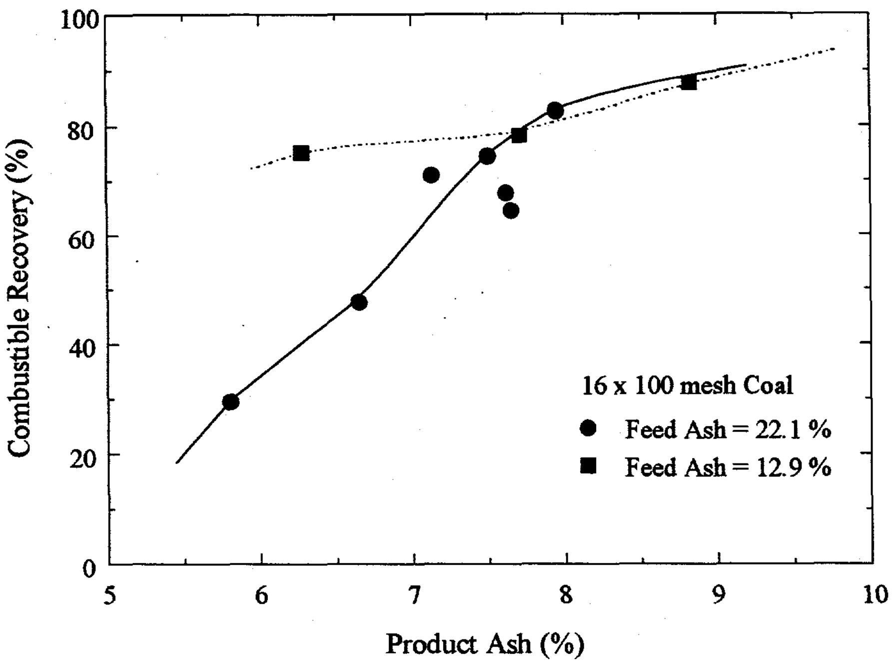
During this reporting period, the effect of changing feed composition on the performance of the Falcon Concentrator was evaluated for control purposes. Figure 4 summarizes the results obtained from changes in the feed ash content. For the + 100 mesh size fraction, the ash content was reduced from 22.1% to 8.0% while recovering 82.7% of the combustible material. A further decrease in product ash content to 6.7% resulted in a sharp decrease in recovery to 42.0% After decreasing the feed ash content in this size fraction to 12.9%, the Falcon was able to reduce the ash content further to 6.3% while recovering 78% of the combustibles. Likewise, for the 100 x 400 mesh size fraction, about 5 - 10% improvement in combustible recovery was achieved at a given product ash content when the feed ash content was reduced from 31.6% to 24.0%. Visual observations made of the particle bed formed contiguous to the bowl wall inside the Falcon revealed a much thicker bed when a high ash content material being treated. Therefore, it can be postulated that the lower recovery values achieved as the feed ash content is increased may be due to entrapment of coal particles in the high-ash content particle bed formed next to the bowl wall.

Figure 5 presents the results obtained from changing feed total sulfur contents. Products containing a slightly lower total sulfur content were obtained when the feed sulfur content was decreased. For example, the sulfur content in the 16 x 100 mesh size fraction was reduced from 7.80% to 2.64% while recovering 82.7% of the combustible material. After decreasing the feed total sulfur content to 5.00%, the Falcon unit reduced the sulfur content to about 2.52% at nearly the same recovery value. This improved sulfur reduction is most likely due to the natural by-pass of heavy particles that is inherent of the Falcon Concentrator. Past studies by the principal investigator has revealed that 5 - 10% of the heavy particle are by-passed to the concentrate, most likely due to insufficient centrifugal force or hindered-settling toward the bowl wall. Increasing the applied centrifugal force from the 93 *g*'s used to obtain these test results to 150 *g*'s has been found to reduce the amount of by-pass.

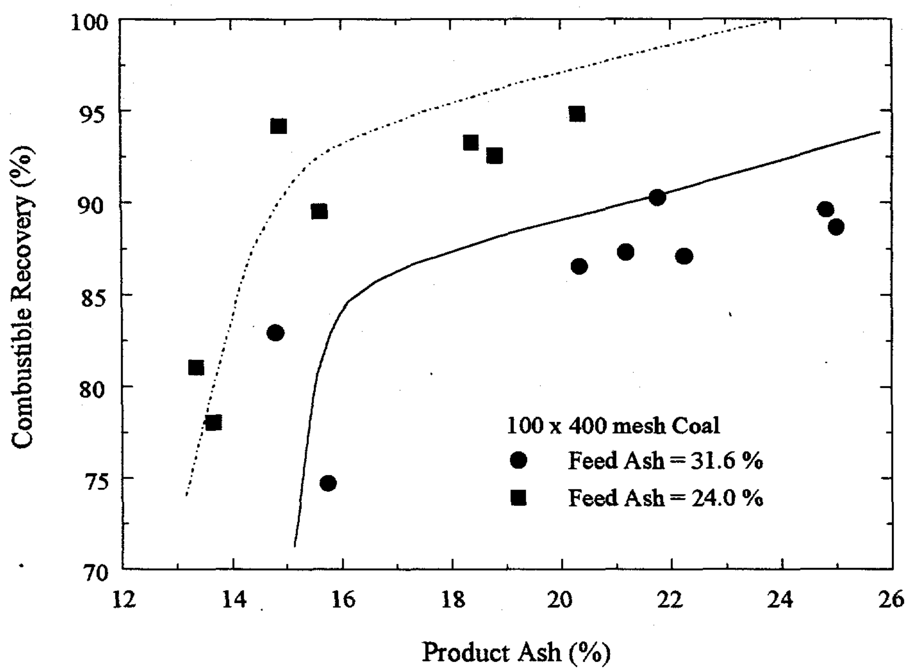
CONCLUSIONS AND RECOMMENDATIONS

Results obtained during this reporting period indicate that feed composition has a significant affect on the quality of the product and the overall recovery obtained from the Falcon Concentrator. Higher combustible recovery values were achieved when the ash content in the feed was decreased, most likely due to a reduced amount of entrapment of coal particles within the high-ash content particle bed formed next to the bowl wall inside the Falcon. Lower levels of ash and total sulfur contents were also achieved when the amount of ash-bearing material in the feed was decreased. This finding is likely due to the relatively small amount of by-pass (i.e., 5 - 10%) of heavy particles to the concentrate that is inherent of the Falcon Concentrator.

Since the feed composition often changes in an operating preparation plant, a control scheme is required to counter the negative effects on the performance of the Falcon Concentrator. Past studies have found that an increase in bowl speed and manipulation of tailings rate can be used to reduce the amount of by-pass, thereby, reducing the affect of changing feed composition on overall product quality. Thus, the use of an on-line sensor,

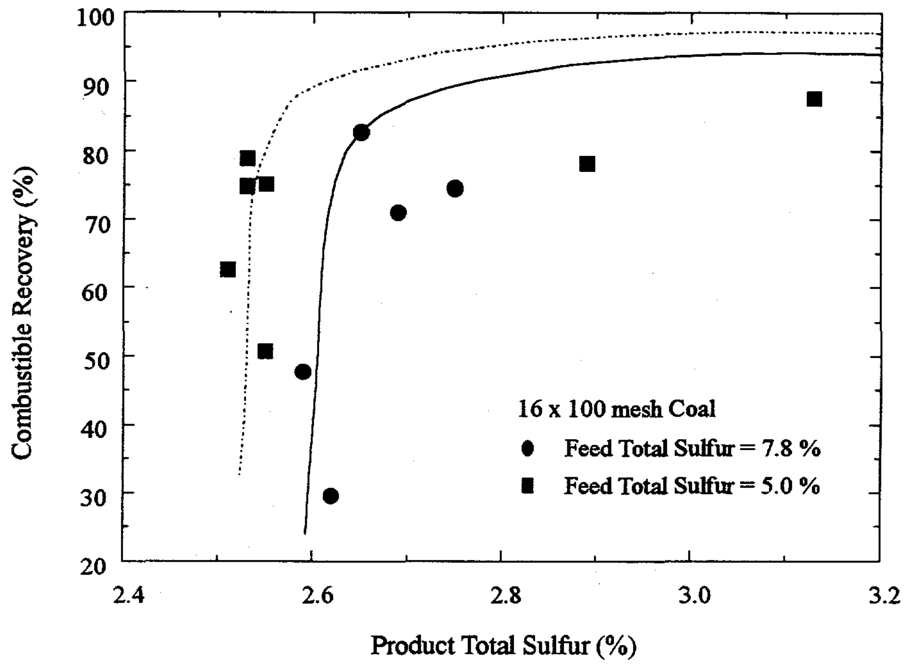


(a)

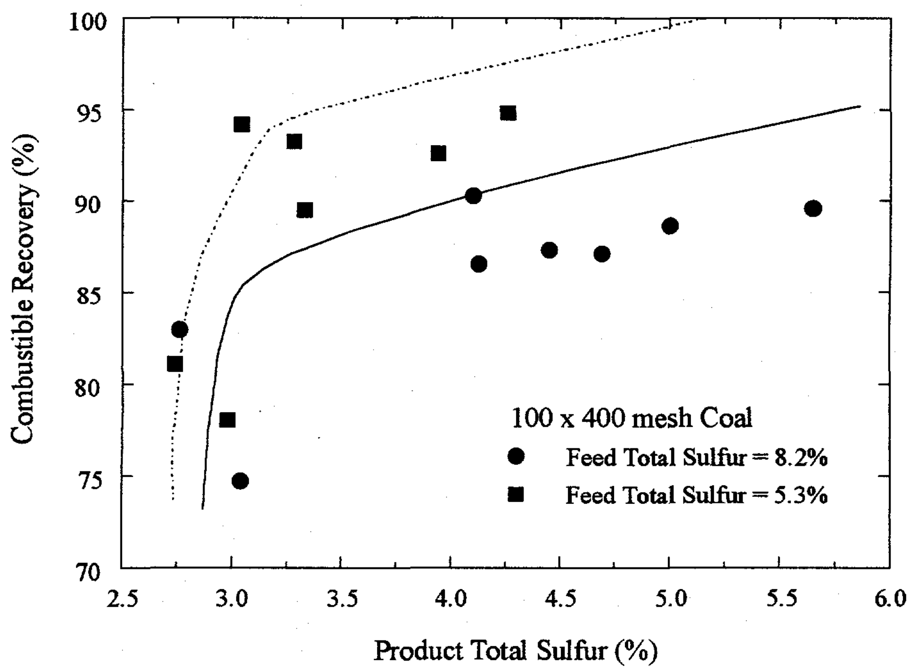


(b)

Figure 4. Test results obtain from the Falcon concentrator showing the effect of changing feed ash contents on the separation performance achieved on the (a) 16 x 100 mesh and (b) 100 x 400 mesh size fractions; feed solids content = 14% by weight.



(a)



(b)

Figure 5. Test results obtain from the Falcon concentrator showing the effect of changing feed total sulfur ash content on the separation performance achieved on the (a) 16 x 100 mesh and (b) 100 x 400 mesh size fractions; feed solids content = 14% by weight.

such as the AMDEL system, appears to be required to achieve efficient operation in an operating plant.

Work during the upcoming reporting period will concentrate on the installation and testing of the AMDEL control system in the Illinois Coal Development Park. In addition, the circuit components will be ordered, transferred and installed in Kerr-McGee's Galatia preparation plant.

DISCLAIMER STATEMENTS

PROJECT MANAGEMENT REPORT
September 1, 1995, through November 30, 1995

Project Title: **IN-PLANT TESTING OF A NOVEL COAL CLEANING CIRCUIT USING ADVANCED TECHNOLOGIES**

DOE Cooperative Agreement Number: DE-FC22-92PC92521 (Year 4)
ICCI Project Number: 95-1/1.1A-1P
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Project Manager: K. Ho, ICCI

COMMENTS

Due to the licensing problems with the AMDEL control unit, which has three nuclear sources, work that was originally scheduled for this reporting period involving the unit could not be conducted. It is expected that the licensing will be completed by the end of December 1995 and, thus, the work involving the unit will soon start thereafter.

Purchasing and installation of required equipment for the circuit test program at the Galatia preparation plant will be completed during the next reporting period.

The significantly lower estimated project budget compared to the projected budget for this reporting period is reflective of the delay in the start of the AMDEL test program.

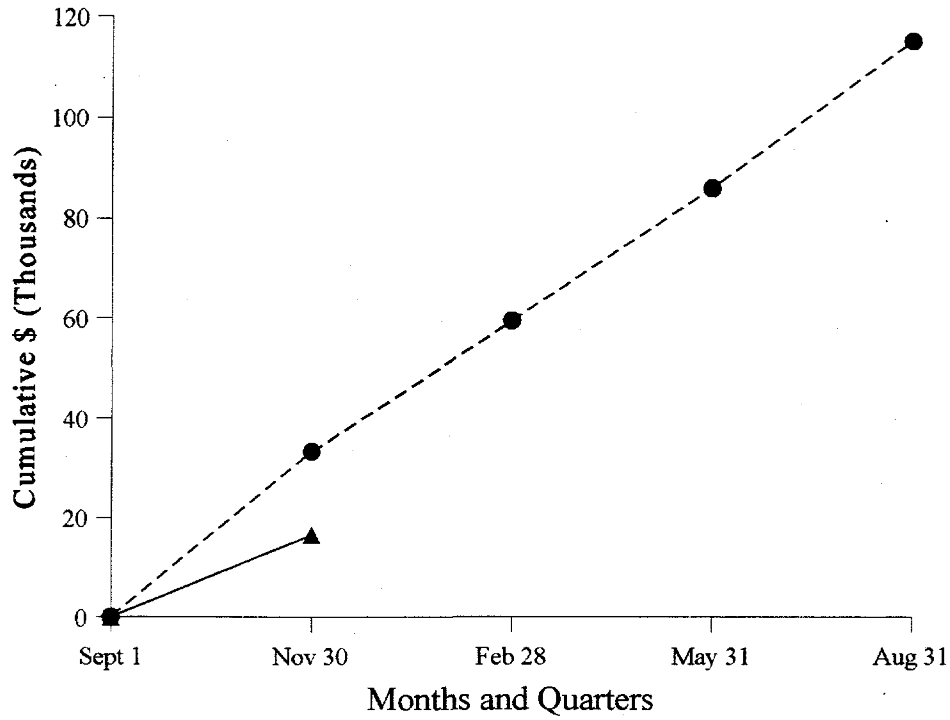
PROJECTED AND ESTIMATED EXPENDITURES BY QUARTER

Quarter*	Types of Cost	Direct Labor	Fringe Benefits	Materials and Supplies	Travel	Major Equipment	Other Direct Costs	Indirect Cost	Total
Sept. 1, 1995 to Nov. 30,1995	Projected	13,348	3,849	2,500	500	4,500	5,700	3,040	33,437
	Estimated	12,811	1,041	1084	0	0	182	1,512	16,630
Sept. 1, 1995 to Feb. 28, 1996	Projected	26,696	7,698	4,500	1,000	4,500	9,900	5,429	59,723
	Estimated								
Sept. 1, 1995 to May 31, 1996	Projected	40,044	11,547	5,900	1,500	4,500	14,900	7,839	86,230
	Estimated								
Sept. 1, 1995 to Aug. 31, 1996	Projected	53,392	15,136	6,800	2,500	4,500	22,800	10,513	115,641
	Estimated								

*Cumulative by Quarter

CUMULATIVE COSTS BY QUARTER

In-Plant Testing of a Novel Coal Cleaning Circuit Using Advanced Technologies



● = Projected Expenditures - - - - - - -

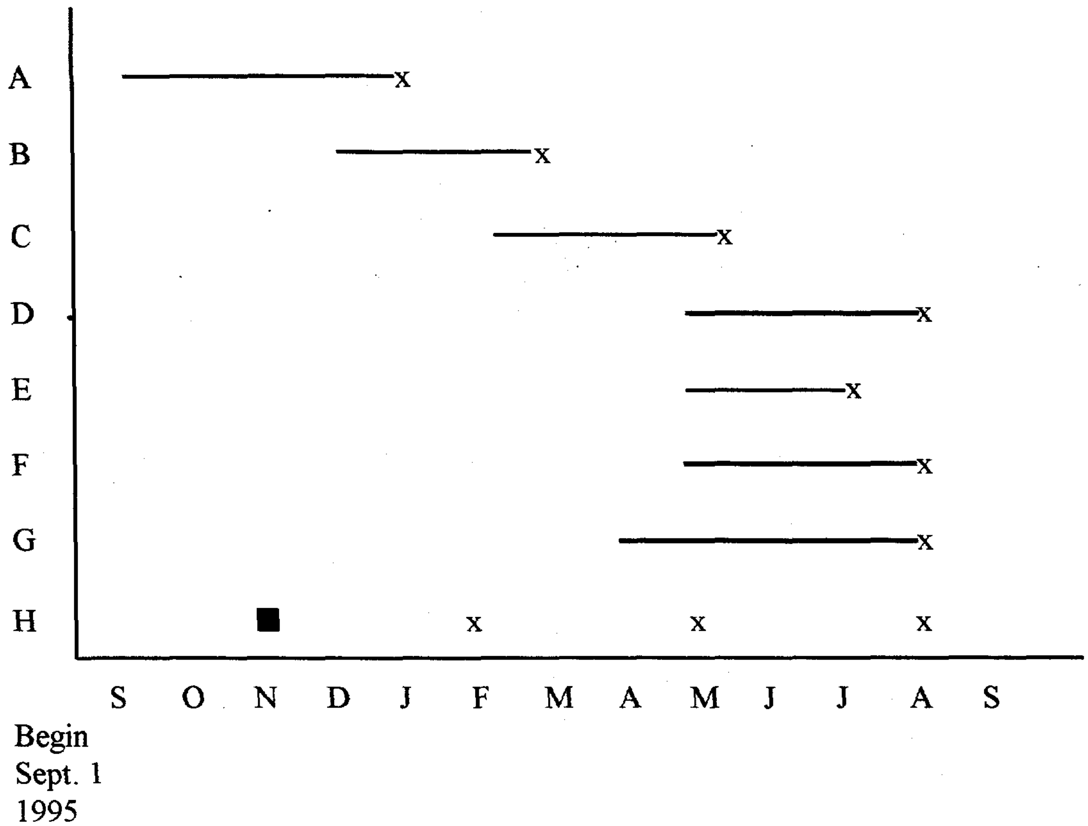
▲ = Actual Expenditures ______________

Total Illinois Clean Coal Instutute Award $115,641

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

SCHEDULE OF PROJECT MILESTONES



Hypothetical Milestones:

A: Pilot Plant Testing of the On-line Coal Slurry Sensor completed (Task 1)
B: Fine Coal Circuit installed (Task 2)
C. Circuit Process Parameters optimized (Task 3)
D. Fine Coal Circuit compared with existing Circuit (Task 4)
E. Long Term Testing completed (Task 5)
F. Economic Comparison completed (Task 6)
G. Tests for Phase II Compliance Coal completed (Task 7)
H. Quarterly and Final Reports completed as submitted (Task 8)

Comments:

None.