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REPORT 2

JANUARY-MARCH 1995

POC-SCALE TESTING
OF AN ADVANCED FINE COAL DEWATERING EQUIPMENT/TECHNIQUE

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EXECUTIVE SUMMARY

Froth flotation technique is an effective and efficient process for recovering of ultra-fine (minus 74 μm) clean coal. Economical dewatering of an ultra-fine clean coal product to a 20 percent level moisture will be an important step in successful implementation of the advanced cleaning processes. This project is a step in the Department of Energy's program to show that ultra-clean coal could be effectively dewatered to 20 percent or lower moisture using either conventional or advanced dewatering techniques.

The cost-sharing contract effort is for 36 months beginning September 30, 1994. This report discusses technical progress made during the quarter from January 1 to March 31, 1995.

OBJECTIVES AND SCOPE OF THE PROJECT

The main objective of the proposed program is to evaluate a novel surface modification technique, which utilizes the synergistic effect of metal ions-surfactant combination, for dewatering of ultra-fine clean coal on a proof-of-concept scale of 1 to 2 tph. The novel surface modification technique developed at the UKCAER will be evaluated using vacuum, centrifuge, and hyperbaric filtration equipment. Dewatering tests will be conducted using the fine clean coal froth produced by the column flotation units at the Powell Mountain Coal Company, Mayflower Preparation Plant in St. Charles, Virginia. The POC-scale studies will be conducted on two different types of clean coal, namely, high sulfur and low sulfur clean coal. The Mayflower Plant processes coals from five different seams, thus the dewatering studies results could be generalized for most of the bituminous coals.

APPROACH

The project team consist of the University of Kentucky Center for Applied Energy Research (UKCAER), Powell Mountain Coal Company (PMCC) and Andritz Ruthner Inc.

The UKCAER is the prime contractor of the project which has been divided into nine (9) tasks. The clean coal froth generated by the 'Ken-Flote' columns at the PMCC Mayflower Preparation Plant will be utilized for dewatering studies using hyperbaric, centrifuge and vacuum dewatering techniques.

ACCOMPLISHMENTS DURING THE QUARTER

The project team held a meeting at the PMCC Mayflower Preparation Plant to discuss the strategy on installation and operation of the various dewatering units. Samples of the low sulfur and high sulfur clean coal froths were collected and shipped to UKCAER and Andritz. The team identified the utility needs for each equipment and a place where the equipment will be installed. The Andritz hyperbaric pilot filter unit was installed at the Mayflower Preparation Plant. A series of tests were conducted with high sulfur coals. The test identified that using 3 bar (43.5 psi) pressure at 1.5 rpm filter speed and 165° cake formation angle, a filter cake of 18 mn thickeners with 23.6 percent moisture could be obtained. Under these conditions, the solids throughput was 165 $lb/ft^2/hr$ and air consumption was 460 scfm/ton.

INTRODUCTION

For cleaning of coal finer than 0.5 mm (28 mesh) processes based on surface chemical technique such as froth flotation and oil agglomeration are the most effective. However, froth flotation process, which is commercially used, produces a product containing 80 percent moisture. Recently developed column flotation technique, which provides higher recovery of low ash product, also suffers from the same problem of high moisture product. Dewatering of the fine coal to a low (~20 percent) moisture level using conventional filtration equipment has not been possible. This project offers a novel surface-modification approach to modify coal surface so it could dewater to a low moisture level using conventional and advanced dewatering equipment. The surface modification approach has provided significant reduction in filter cake moisture in laboratory studies at University of Kentucky Center for Applied Energy Research.

The aim of this program is to test the UKCAER-developed novel coal surface modification approach on a pilot scale at the rate of 1-2 tph of solids using vacuum, centrifuge and hyperbaric filtration technique. This proof-of-concept testing is being performed at the Powell Mountain Coal Company Mayflower Plant located in St. Charles, Virginia.

The project involves a teaming arrangement between the University of Kentucky for Applied Energy Research (CAER), the Powell Mountain Coal Company (PMCC), and the Andritz Ruthner Inc. (ARI). The project will extend for a period of 36 months.

APPROACH

A team of scientists and engineers from the Center for Applied Energy Research, Powell Mountain Coal Company, and Andritz Ruthner Inc. has been formed to accomplish the objectives of the program. Each team member brings fine particle dewatering knowledge and experience to the project. The UKCAER, who is the prime contractor, will manage the project and will conduct the major part of the study. The PMCC will provide assistance and facility in conducting the pilot scale tests, and ARI will conduct laboratory dewatering tests and also pilot scale tests using the hyperbaric pressure filtration unit at the PMCC. Figure 1 shows the project organization chart. The project schedule for the first two years of the program is shown in Figure 2.

The CAER collected clean coal froth samples from the Mayflower plant for the laboratory studies. Samples of clean coal slurries were also sent to ARI for studies using their laboratory scale hyperbaric unit. At both organizations, emphasis will be given to identify optimum process and operating conditions using vacuum and pressure techniques to dewater the clean coal slurry to about 20 percent level moisture. It is believed that the proposed research can achieve low moisture product on a pilot scale to the same extent which has already been achieved in laboratory studies.

The basic components of the process has been tested in laboratory. The purpose of the proposed work here is to evaluate all of the component steps on a consistent basis, and, to the extent possible in laboratory studies, demonstrate the feasibility of their integration. The outcome of this program will be to identify a process/technique combination which is able to achieve a 20 percent or lower moisture in the fine clean coal product and to provide technical and economic evaluation of the integrated concept in sufficient detail for a coal company to decide to install the dewatering process in their plant.

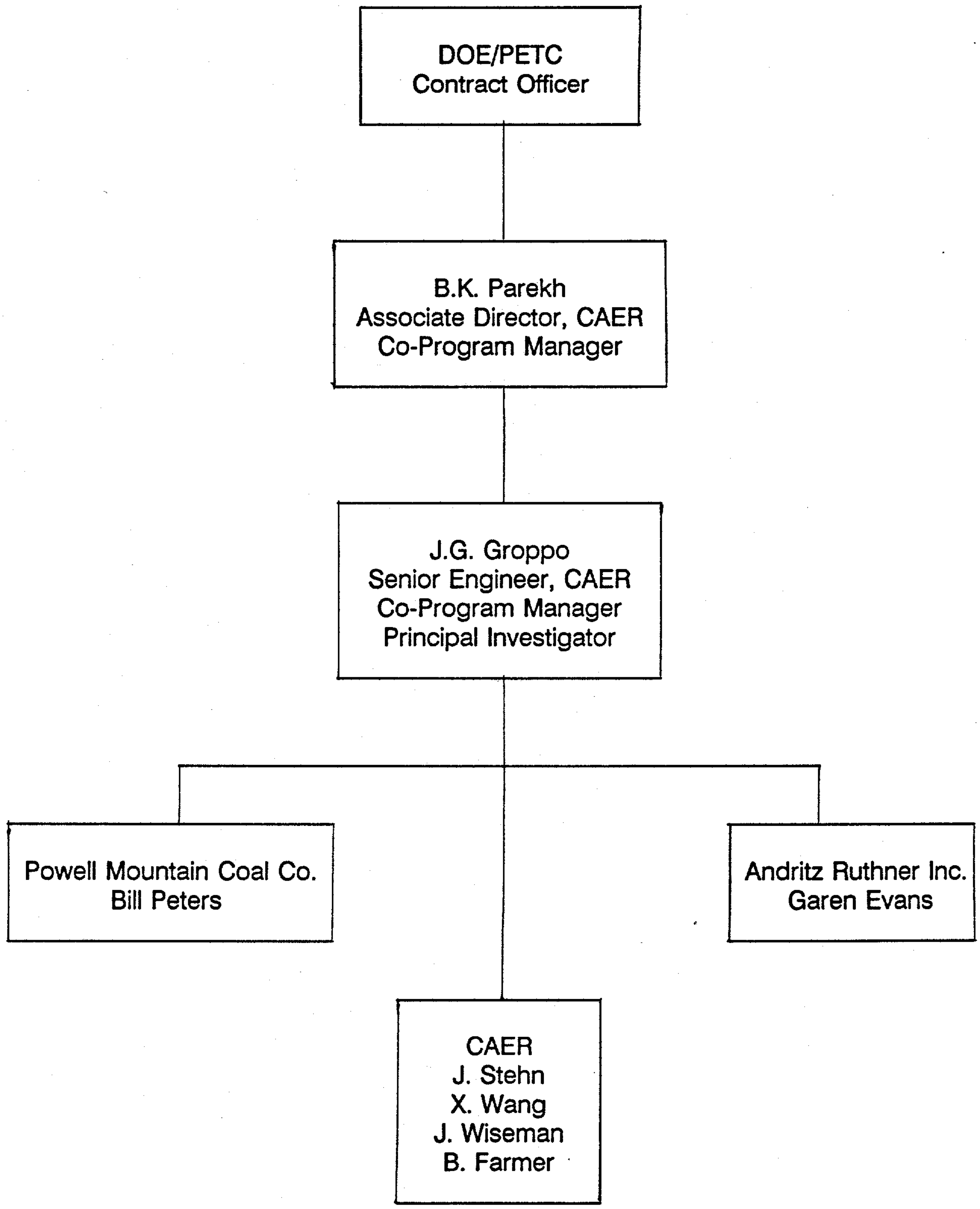


Figure 1. Project management organization chart

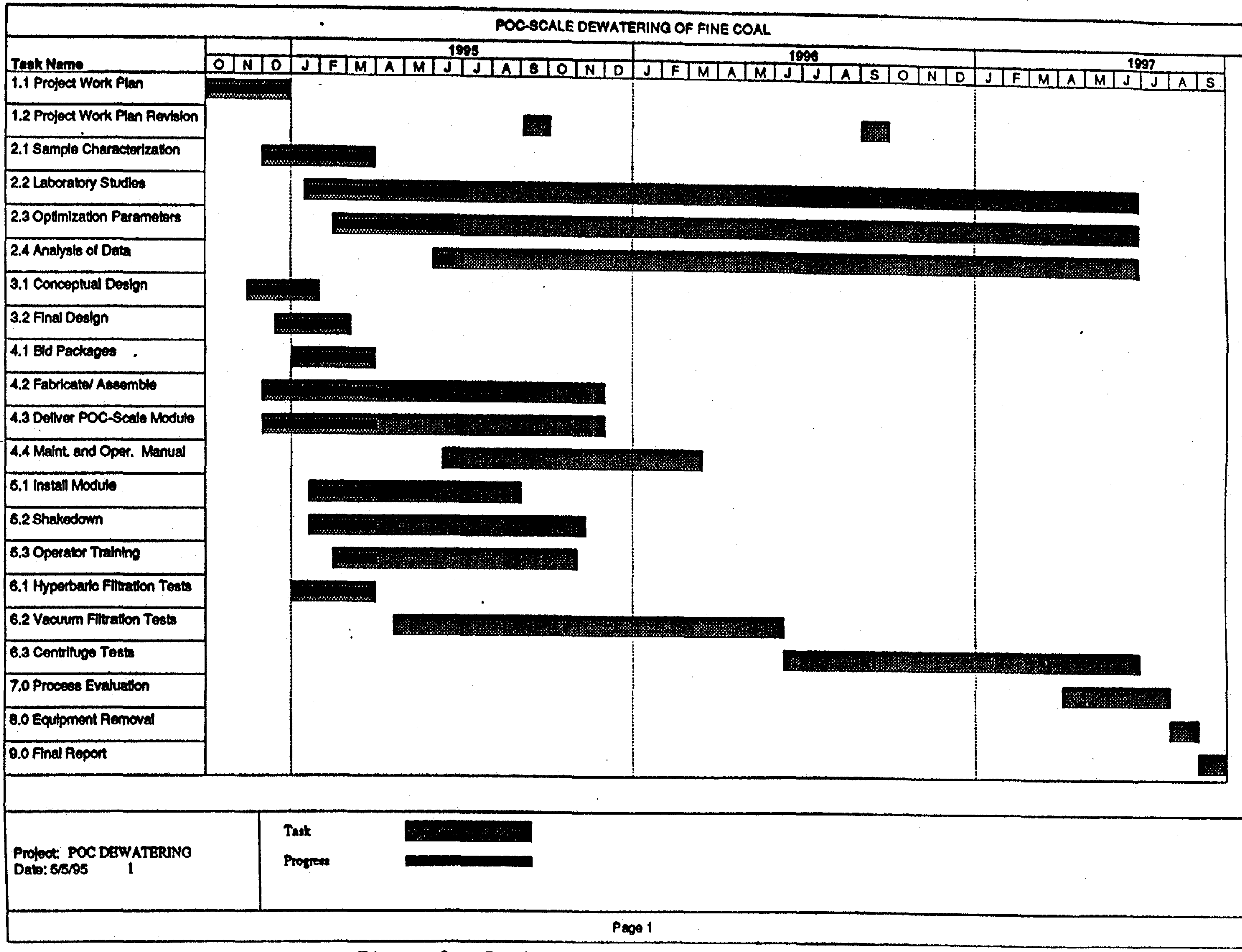


Figure 2. Project schedule

ACCOMPLISHMENTS DURING THE QUARTER

The project has been divided into tasks and subtasks as listed in Table 1. Each task and subtask has specific objective which can be inferred from its title. During this quarter (January 1 to March 31, 1995) work was done on Tasks 2, 3, 4, 5 and 6.

Task 2. Sample Analysis and Laboratory Testing:

Samples of the low- and high-sulfur clean coal froth slurry were collected from the columns operating at the Powell Mountain Coal Company. Figures 3 and 4 show the particle size distribution of the high sulfur and low sulfur clean coal slurries. Note, that D_{50} of high sulfur and low sulfur clean coal slurries is 25 μm and 32 μm, respectively.

Fundamental Filtration Characteristics of the PMCC Coal Slurry. An understanding of the relationship betweens the cake resistance, medium resistance and operating variables, including pressure, solid concentration, and particle size distribution, is of great importance. During this period of the project, the effects of applied pressure on the filtration kinetics and final moisture content have been systematically examined. From the filtration kinetics data, the specific cake resistance and medium resistance have been evaluated at each applied pressure, and the relationship between the resistance and pressure has been investigated to determine the compressibility of the filter cake.

The effect of applied pressure on the moisture content of the filter cake of the low sulfur clean coal slurry at different filtration time is shown in Figure 5. The results demonstrate that the moisture content decreases sharply as the pressure is increased

Table 1. Outline of Work Breakdown Structure

Task 1.	Project Work Planning	
	Subtask 1.1	Project Work Plan
	Subtask 1.2	Project Work Plan Revisions
Task 2.	Samples Analysis and Laboratory Testing	
	Subtask 2.1	Acquisition and Characterization of Samples
	Subtask 2.2	Laboratory Scale Testing
	Subtask 2.3	Optimization of Parameters
	Subtask 2.4	Analysis of Data
Task 3.	Engineering Design	
	Subtask 3.1	Conceptual Design Package
	Subtask 3.2	Final Design Package
	Subtask 3.3	Construction Schedule
Task 4.	Procurement and Fabrication	
	Subtask 4.1	Bid Packages
	Subtask 4.2	Fabricate/Assemble Components
	Subtask 4.3	Deliver POC-Scale Module and Install
	Subtask 4.4	Maintenance and Operating Manual
Task 5.	Installation and Shakedown	
	Subtask 5.1	Install and Tie-in Module
	Subtask 5.2	Startup Procedures/Shakedown
	Subtask 5.3	Operators Training
Task 6.	System Operation	
	Subtask 6.1	Test Coal No. 1
	Subtask 6.2	Test Coal No. 2
Task 7.	Process Evaluation	
Task 8.	Equipment Removal	
Task 9.	Reporting	
	Subtask 9.1	Monthly Reports
	Subtask 9.2	Project Final Report

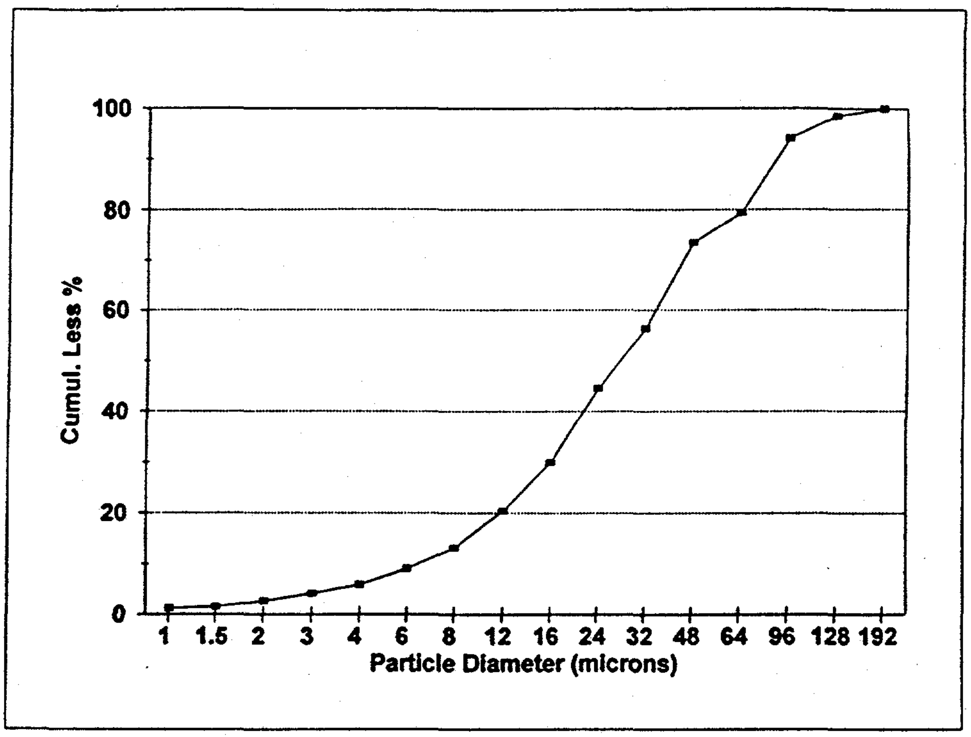


Figure 3. Particle size distribution of high sulfur (non-compliance) clean coal slurry

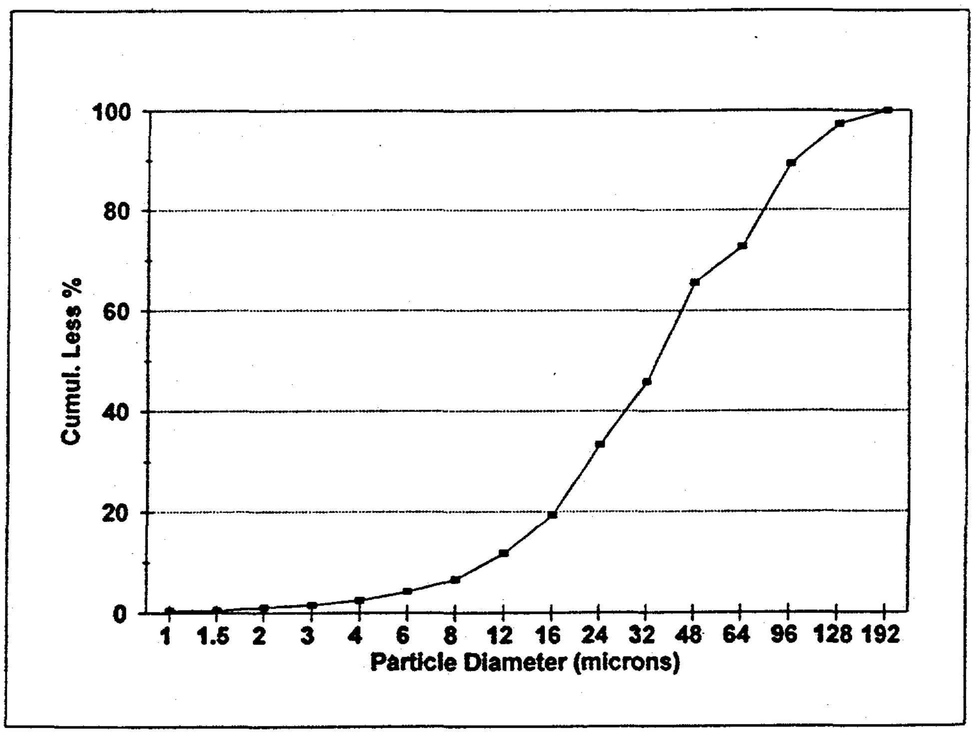


Figure 4. Particle size distribution of low sulfur (compliance) clean coal slurry

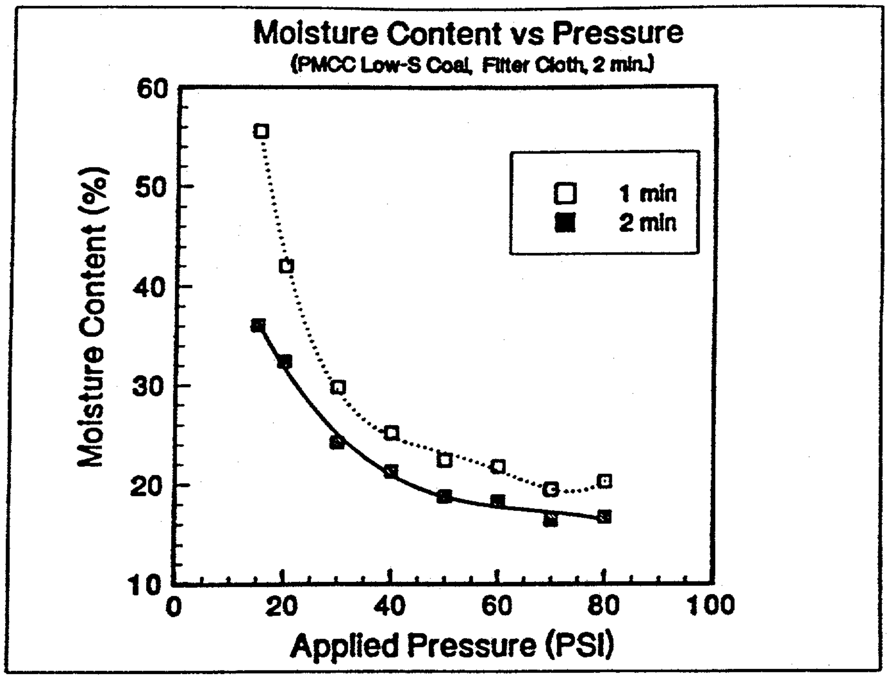


Figure 5. Laboratory dewatering data on effect of applied pressure on filter cake moisture

from 15 psi (vacuum pressure) to 50 psi. Further increase in pressure above 50 psi provided minimum moisture reduction.

Figure 6 shows filtration data for the low-S clean coal slurry, in which the cumulative filtrate volume is plotted as a function of filtration time under various applied pressure. It can be seen that as the pressure increases, the filtration rate increases, while the cake formation time, t_{cf}, decreases. The cake formation time can be readily determined from the data. For example, at $\Delta P=30$ psi, $t_{cf} = 45$ sec, while at $\Delta P=40$ psi, $t_{cf} = 28$ sec. Figure 7 shows the Darcy-Kozney plot, that is, the plot of t/V vs V. As predicted by eqn.(1), a good linear relationship is displayed for all the filtration pressure investigated. The results indicate that within the studied pressure

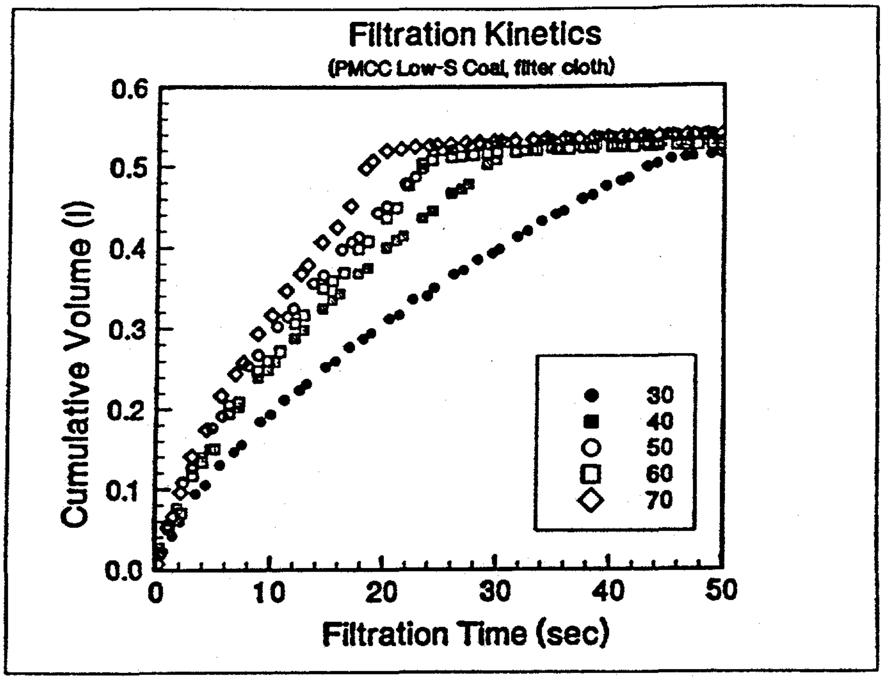


Figure 6. Cumulative filtrate volume as a function of filtration time under different applied pressure for the low sulfur coal slurry

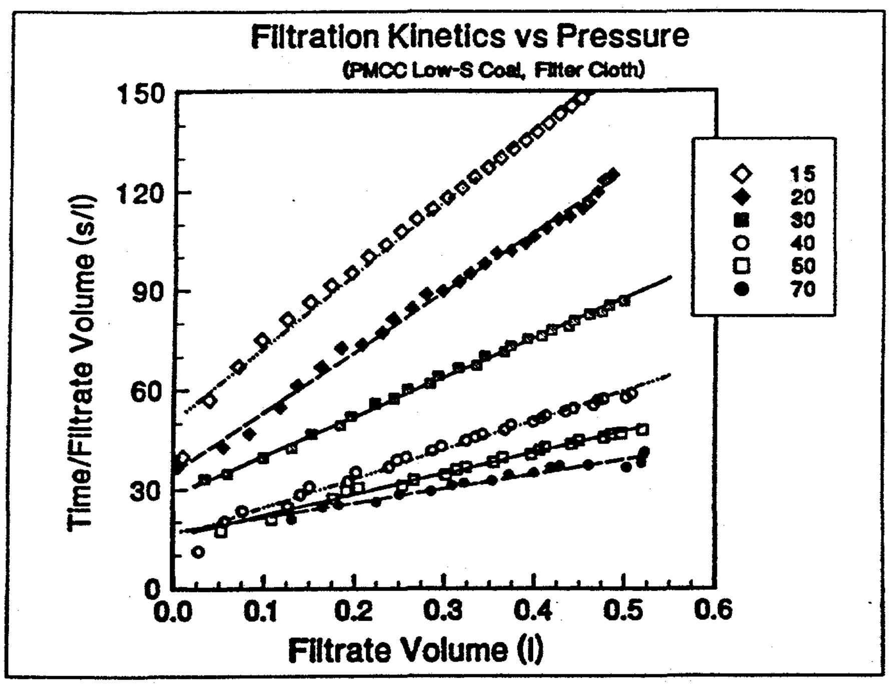


Figure 7. Darcy-Kozney plot under different applied pressure for the low sulfur clean coal slurry

range, the slope (S_α) decreases with increasing pressure. The plot of log(S_α) vs log (ΔP) gives a perfect straight line with a slope of -1, as shown in Figure 8. This means that n=0, that is, the filter cake is incompressible. Figure 9 reveals the calculated specific cake resistance (using equations (3) and (10)) as a function of the applied pressure. It can be seen that α remains a constant. These results are in excellent agreement with each other.

Figure 10 shows the intercept of the t/V vs V plot as a function of pressure. It can be seen that the intercept decreases with increasing pressure at the lower pressure range. However, above 60 psi, the intercept remains almost a constant as the pressure increases. Figure 11 compares the medium resistance (R_m) with the specific cake resistance as a function of pressure. It is interesting but surprising to note that the medium resistance increases with increasing pressure. This may be interpreted by the role of deposition of suspension particulates in the pores of the supporting medium, since the medium resistance is defined by

$$R_m = \frac{L_m}{K_m}$$

where L_m is the thickness of medium, and K_m is the average permeability of the medium. It is reasonable to assume that the thickness of the medium (L_m) remain a constant at different pressure. Therefore, an increase in R_m suggests a decrease in K_m. This means that increasing applied pressure will lead to deposition of more suspension particulates in the pores of the supporting medium by decreasing the medium permeability.

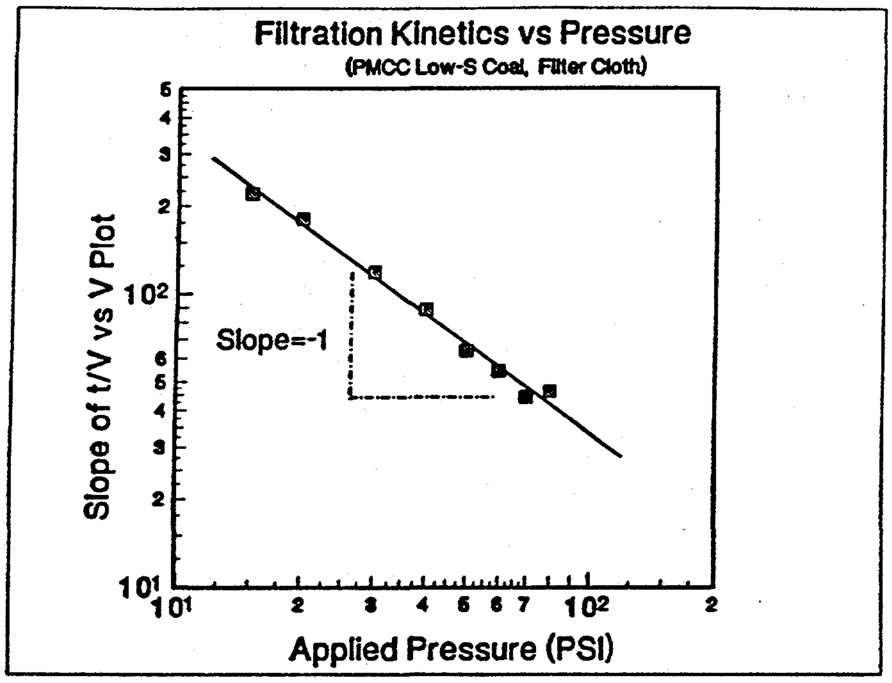


Figure 8. The slope of Darcy-Kozney plot (Fig. 7) as a function of applied pressure

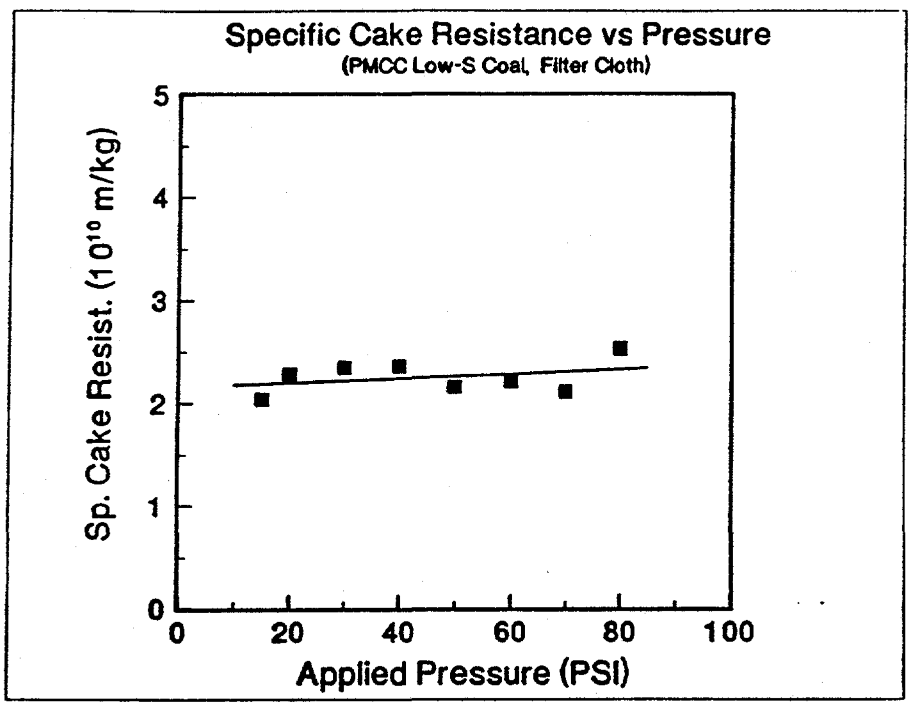


Figure 9. Specific cake resistance (α) as a function of applied pressure for the low sulfur clean coal slurry

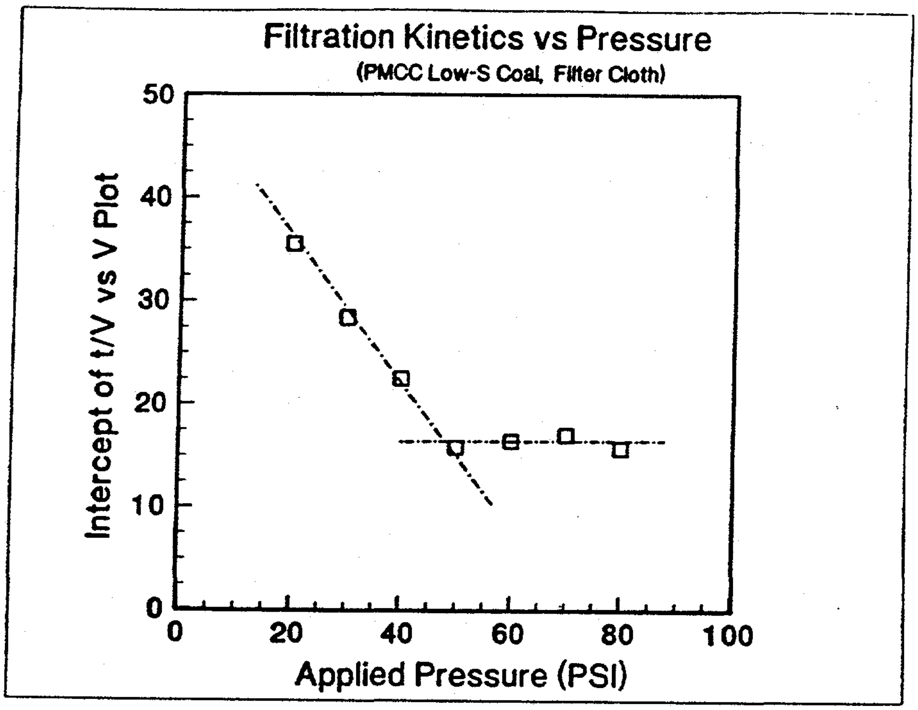


Figure 10. The intercept of Darcy-Kozney plot (Fig. 7) as a function of the applied pressure during filtration

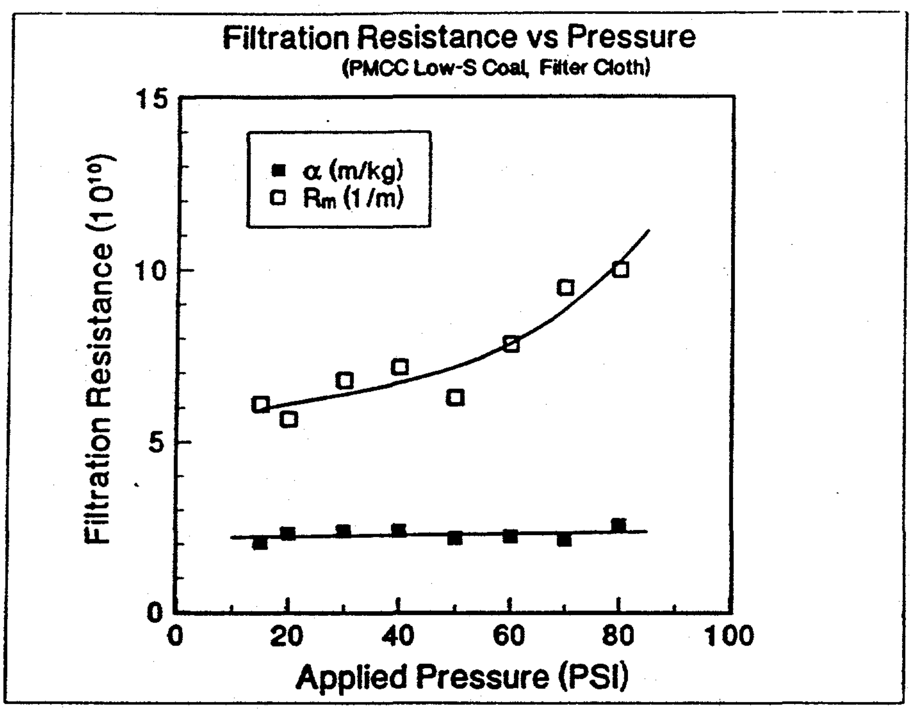


Figure 11. Specific cake resistance (α) and medium resistance (Rm) as a function of applied pressure for the low sulfur coal slurry

It is interesting to note that a good relationship exist between the final moisture content and the medium resistance (Figure 12). Figure 12 compares the moisture content and medium resistance as a function of the applied pressure. As has been discussed above, above a certain pressure (50 psi), the medium resistance increases sharply with increasing pressure, correspondingly, the moisture reduction becomes much less significant. These results clearly demonstrate that for the studied coal, the medium resistance plays a key role in moisture reduction.

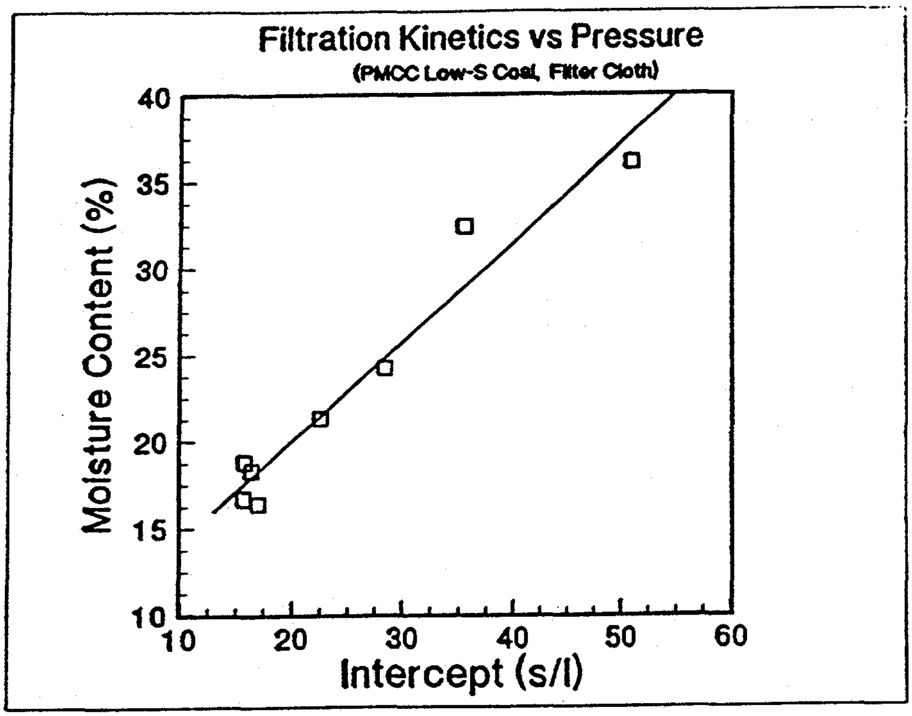


Figure 12. Moisture content as a function of the intercept of Darcy-Kozney plot (Fig. 7)

Task 3. Engineering Design

This is a detailed account of the design and construction of the pilot plant called for in the Management and Project Work Plan (M&PWP). As per the M&PWP

for the above named project, the following information concerning the POC pilot plant is described:

- Process Flow Diagram for final design.
- Mass/Energy Balance Calculations.
- Effluent Discharge Management.
- Raw Material and Utility Requirements.

Process Flow Diagram:

Figure 13 shows the generic Process Flow Diagram which was accepted after the conceptualization and initial design study. This diagram was based on a collaborative effort between the engineers at the CAER and the Powell Mountain Coal Company (PMCC) in St. Charles, VA.

The first filter to be tested under pilot plant conditions was the Andritz Hyperbaric Filter (HBF), although its' arrival date was much earlier than the engineering teams at the CAER and PMCC expected. In fact, the early arrival of the Andritz Filter at the PMCC facility coincided with the construction of the pilot plant. As a result, the pilot plant design was modified so as to address the specific needs and limitations of the HBF. These modifications include:

- Feed Tank: The feed tank was combined with conditioning tank. Rather than have 2 separate tanks with a slurry pump in between to transfer the slurry from a feed or holding tank to a tank where reagents could be added, one 500 gallon tank was procured and used as the surge vessel between the feed pipe that delivered slurry from the flotation columns and the filter. Also, the Andritz HBF trailer/facility was equipped with a reagent injection capability.

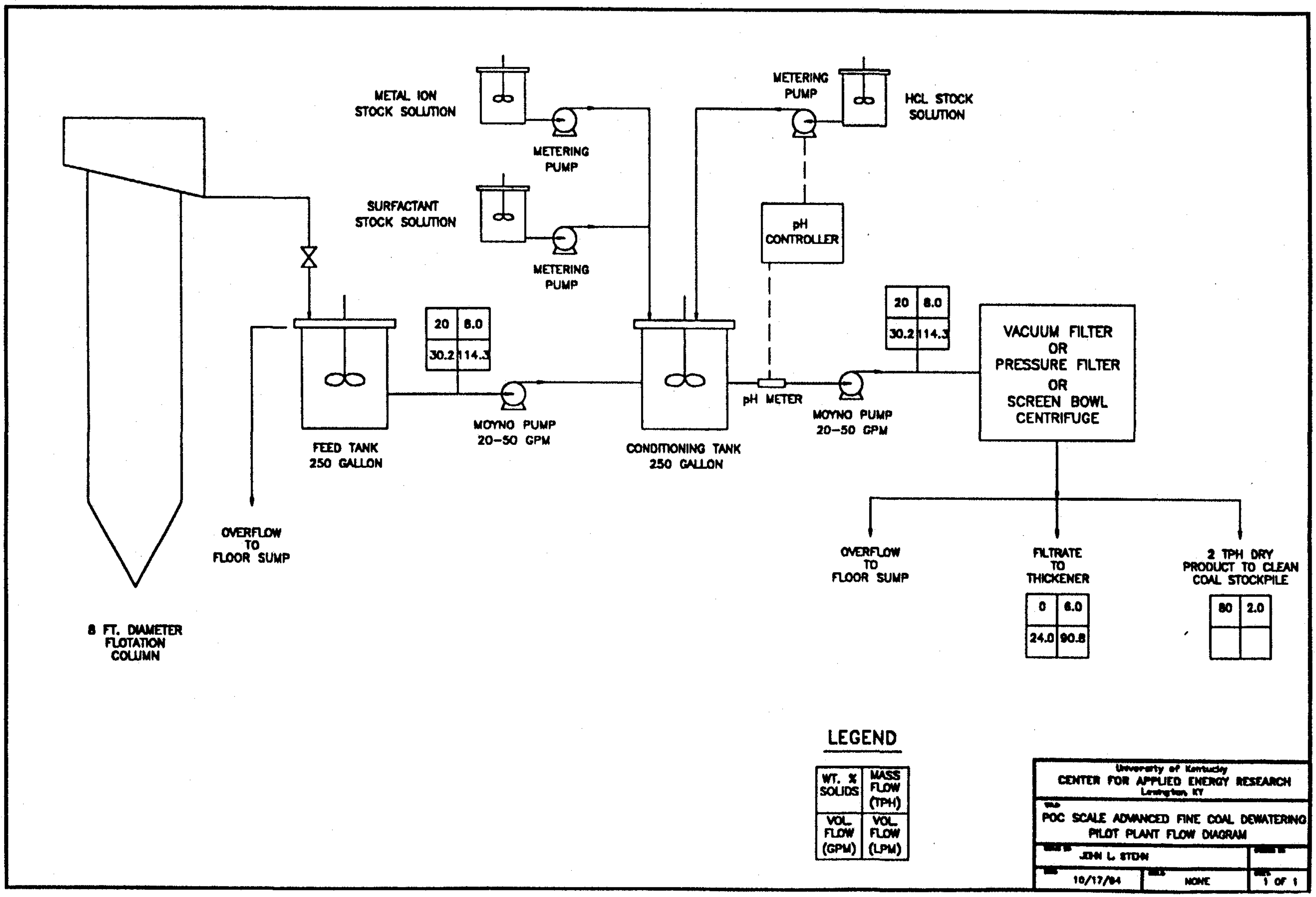


Figure 13. Generic process flow diagram for POC pilot plant.

The proper reagents could be mixed and added as the slurry was fed to the filter and the pH measured all within the HBF facility. This arrangement was deemed superior to the design plan which called for the reagent addition to take place in a mixing tank on the platform above the HBF facility.

► Pumps: The pilot plant facility has been erected on a platform just outside the walls of the preparation facility. This platform is approximately 20 ft. above ground where the filter units will be placed during operation. It was determined that the 2 Moyno pumps called for in the generic process flow diagram would not be needed. The static head created by the 20 ft. elevation of the feed tank was sufficient to provide necessary feed rates for the vacuum and centrifuge filters. The HBF, which requires a high feed rate (66 gpm), is equipped with a centrifugal feed pump that can operate with the existing static head. Since the HBF facility managed the reagent additions, the 3 metering pumps were not required to be installed. One metering pump, with a dedicated pH meter feedback loop, was procured and will be used for the vacuum pump tests.

Figure 14 shows the Process Flow Diagram which represents the how the pilot plant was configured for operation with the Andritz HBF trailer.

Mass/Energy Balance Calculations:

The Andritz HBF facility requires the highest throughput of the three filters to be tested during the operational portion of the project. Therefore, the HBF's required

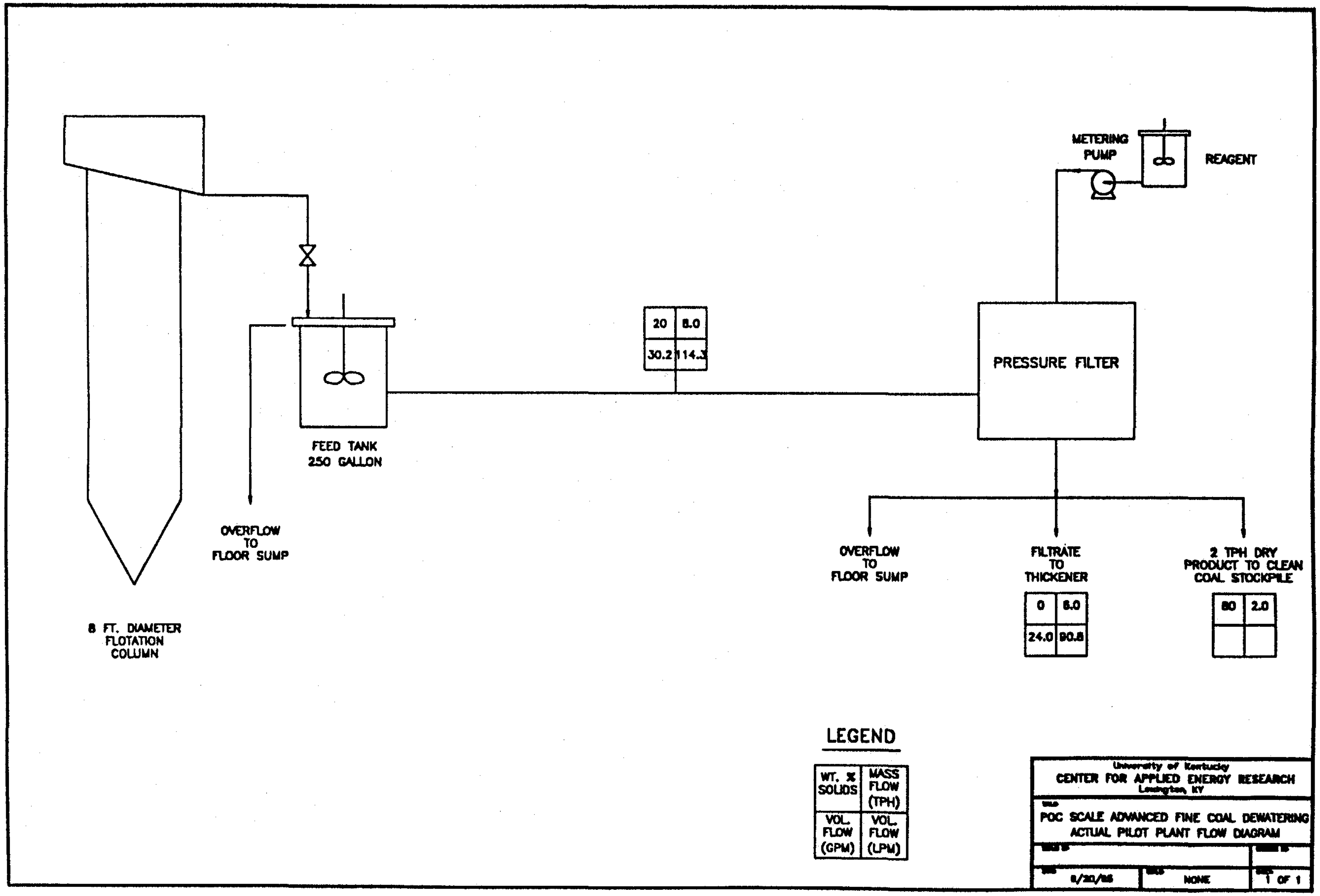


Figure 14. Pilot plant arrangement during HBF trials.

throughput was the design feed rate for the generic pilot plant design. While it was anticipated that the feed rate to the HBF would be as high as 66 gpm, the typical feed rate was only 30 gpm. The lower feed rate is attributed to the fine size distribution of the solids as well as the low solids content of the coal slurry. The mass balance calculations were performed on the basis of:

- Wt. % solids (percentage of solids on a dry basis).
- Mass Flow Rate (tons of dry solids / hour).
- Volumetric Flow Rate (gallons / minute) or (liters / minute).

The concentration of solids in the slurry was measured using representative samples of the slurry sent to the CAER from PMCC. A solids concentration of approximately 20% was measured and was used in all mass balance calculations. The process flow diagram shows the change in solids concentration as the slurry moves through the various stages of the pilot plant. The HBF unit was able to draw enough slurry from the feed tank to maintain continuous operation at all times.

No energy calculations were performed for the Engineering and Design task.

Effluent Discharge Management:

As per the generic process flow diagram, all effluents were discharged to the floor sump, located on the ground floor of the PMCC preparation plant. During HBF operation, there was no overflow due to the operation of the positive displacement pump on the HBF trailer. The filtrate was transported via flexible hose to the floor sump.

The reagents used during operational testing exit the pilot plant on the surface of the product coal cake that is discharged from the filter and collected. Any leftover reagent that was not deposited on the coal surface remains with the filtrate which is discharged to the floor sump.

Raw Materials and Utility Requirements:

Slurry Feedstock: The feedstock for the pilot plant operations was supplied by the flotation columns at the PMCC Preparation Plant. A 4" knife gate valve was installed in the main transport pipe that carries the slurry from the columns to the slurry feed tank. This valve can be adjusted in order to control the volume of slurry in the feed tank of the pilot plant. A 4" PVC pipe line was installed to convey the slurry from the to the pilot plant.

Product Cake: The dry product cake was transported, by means of a conveyer belt, to a temporary stockpile during the HBF operation. The accumulated coal was moved to a product stockpile using a front end loader operated by PMCC personnel.

Electric Power: A 440 VAC, 3 phase power line was connected to the external platform upon which the pilot plant was erected. This line is used to power the stirrer that agitates the feed tank (see figure 2). Any 120 VAC equipment such as pH meters and small metering pumps can be powered using the available wall outlets located inside the preparation plant and extension cords. This arrangement will remain intact through out the pilot plant operational period.

During HBF operation, the Andritz trailer required 120 kW of electric power. A work detail from PMCC connected a 480 VAC, 3 phase line to supply all power for the trailer. This arrangement was used during the HBF operational period.

Chemical Reagents: The following is a list of the reagents to be used throughout the operational portion of the project:

Surfactants

- Sodium 2-Ethylhexyl Sulfate
- Octyl Phenoxy Polyethoxy Ethanol
- 1-Hexadecyl Pyridinium Chloride

Floculants

- Percol 371(Cationic)
- Percol 156(Anionic)

These reagents are stored in a trailer (maintained by the CAER) at the preparation plant for use as needed during pilot plant tests.

Task 4. Procurement and Fabrication

Most of the POC-scale unit components have been acquired and fabricated. The fabricated unit was tested at the PMCC's Mayflower Preparation Plant in conjunction with the Andritz hyperbaric filtration pilot unit.

Task 5. Installation and Shakedown

The POC-scale unit was installed at the Mayflower Preparation Plant and shakedown tests were conducted. As the installation was conducted during January, some problems were encountered due to cold weather, specially with valves controlling flow of coal slurry.

For Andritz hyperbaric filter no operator training was required, as the machine was operated by the Andritz Ruthner Inc. personnel.

Task 6. System Operation

The first system tested for the program was the Andritz hyperbaric unit. Figure 15 shows the hyperbaric unit on a trailer. The pilot hyperbaric unit has on disc of 1.4

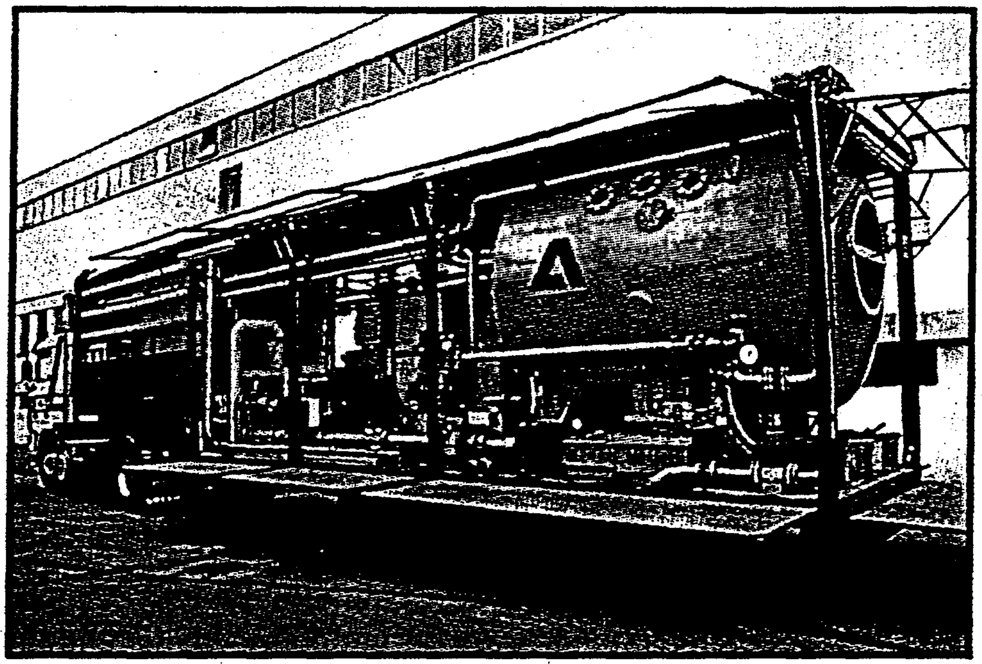


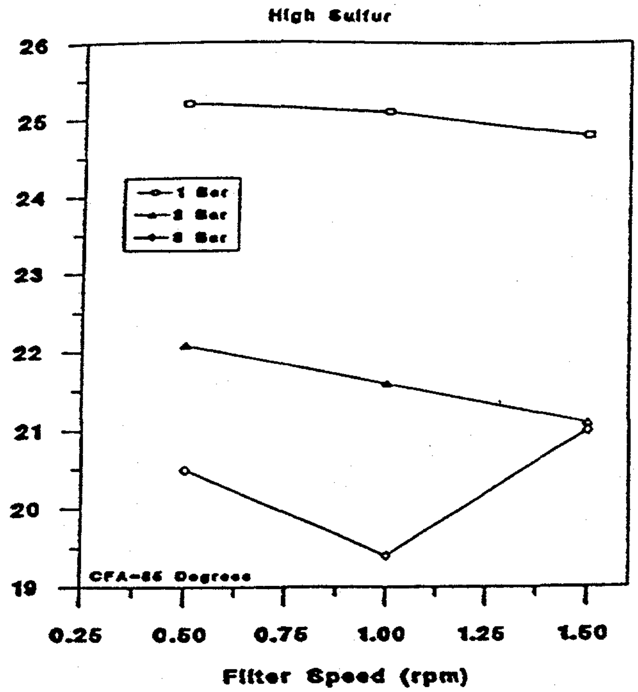
Figure 15. Andritz pilot scale hyperbaric unit

meter (4.6 ft.) diameter with $2m^2$ (22 sq. ft.) filtration area which is enclosed in a 2.5 meter (8.2 ft.) diameter pressure vessel. The trailer-mounted unit is self-sufficient and has its own feed pumps and air compressor. The unit requires 440 volts power to run.

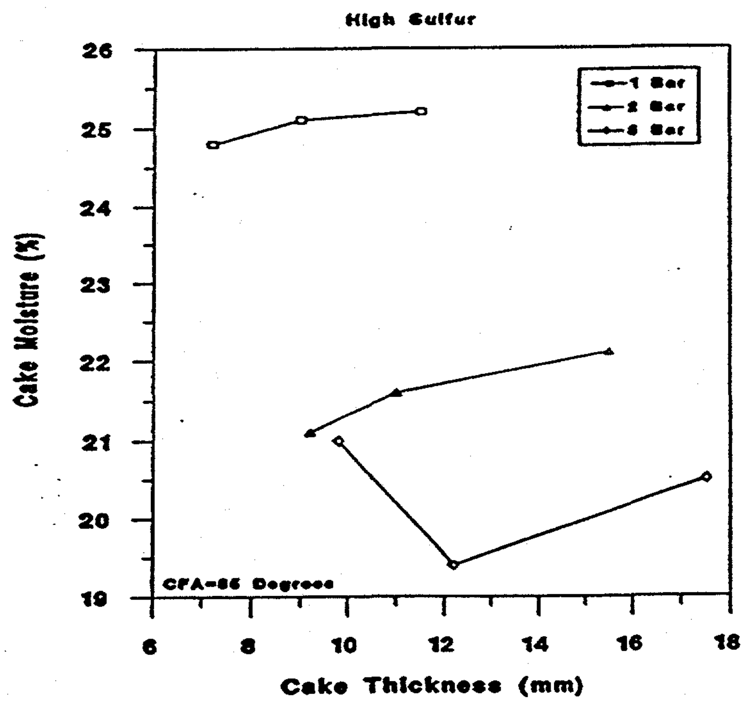
For the POC-scale tests, a small stream column flotation concentrate was diverted to a 500-gallon tank with a stirrer. Volume of the clean coal slurry was maintained around 300 gallons during the testing. For most of the tests, approximately 50 gallons/minute of slurry was utilized. Filter cake was discharged using a belt conveyor every one minute.

Baseline Testing. Baseline testing was conducted with the Andritz hyperbaric pilot filter unit at the Mayflower Preparation Plant using the column flotation froth product as the filter feed. Filter operating parameters were evaluated using both high sulfur and low sulfur coal as substrates. The primary operating variables that were evaluated in baseline testing were cake formation angle (CFA), filter speed and pressure. The CFA refers to the angle of rotation, measured from the horizontal position where the rotating filter element enters the slurry, through which cake formation occurs and is analogous to the more common term 'cake formation time.' The filter speed simply refers to the rotation of the filter disc and is measured in revolutions per minute (rpm) while the pressure is the vessel pressure measured in bar (1 bar = 14.5 psi).

The effect of filter speed on cake moisture for the high sulfur clean coal froth product for different CFA's is shown in Figures 16, 17 and 18. At low CFA of 85°, filter speed had little effect on cake moisture as shown in Figure 16a. This result was not



(a)



(b)

Figure 16. Effects of filter speed (a) and cake thickness (b) on cake moisture for pressure filtration of high sulfur coal at 85° cake formation angle at various vessel pressures

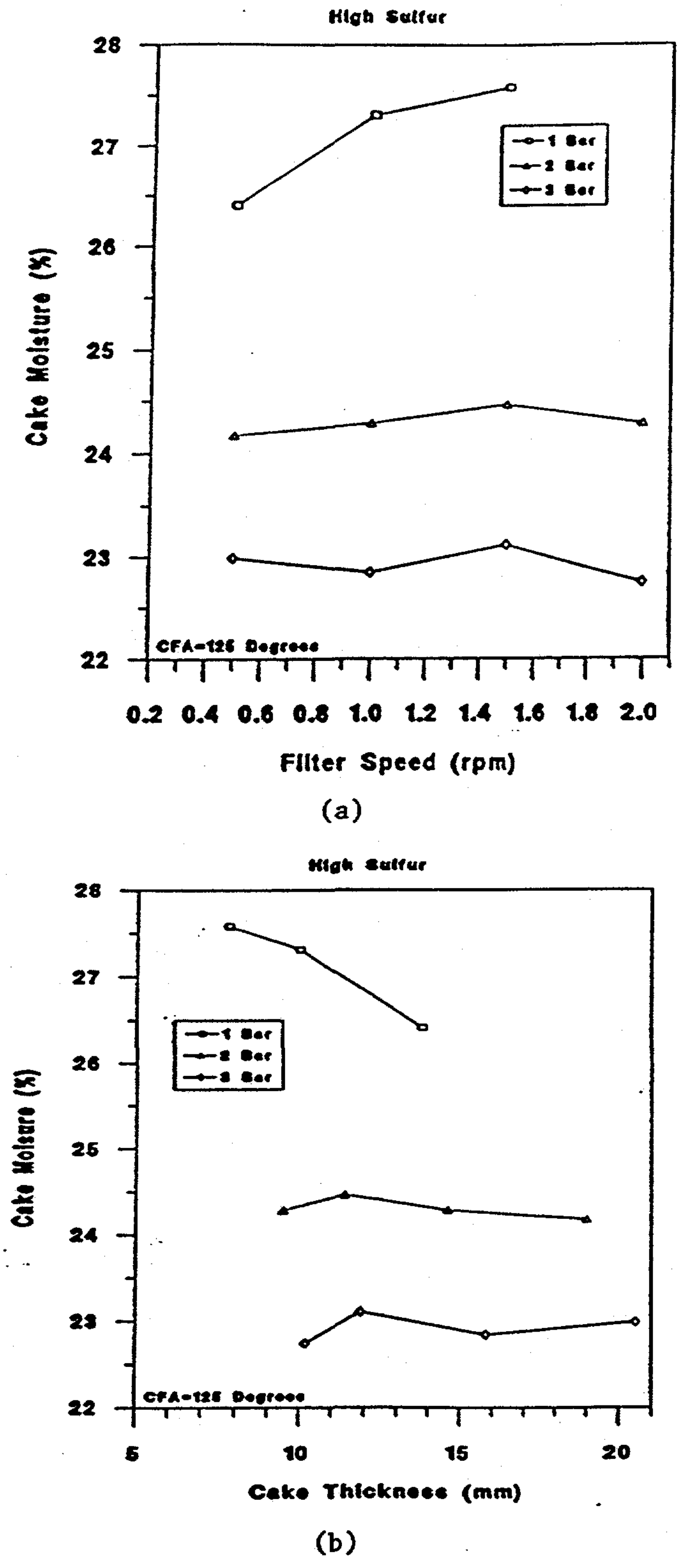


Figure 17. Effects of filter speed (a) and cake thickness (b) on cake moisture for pressure filtration of high sulfur coal at 125° cake formation angle at various vessel pressures

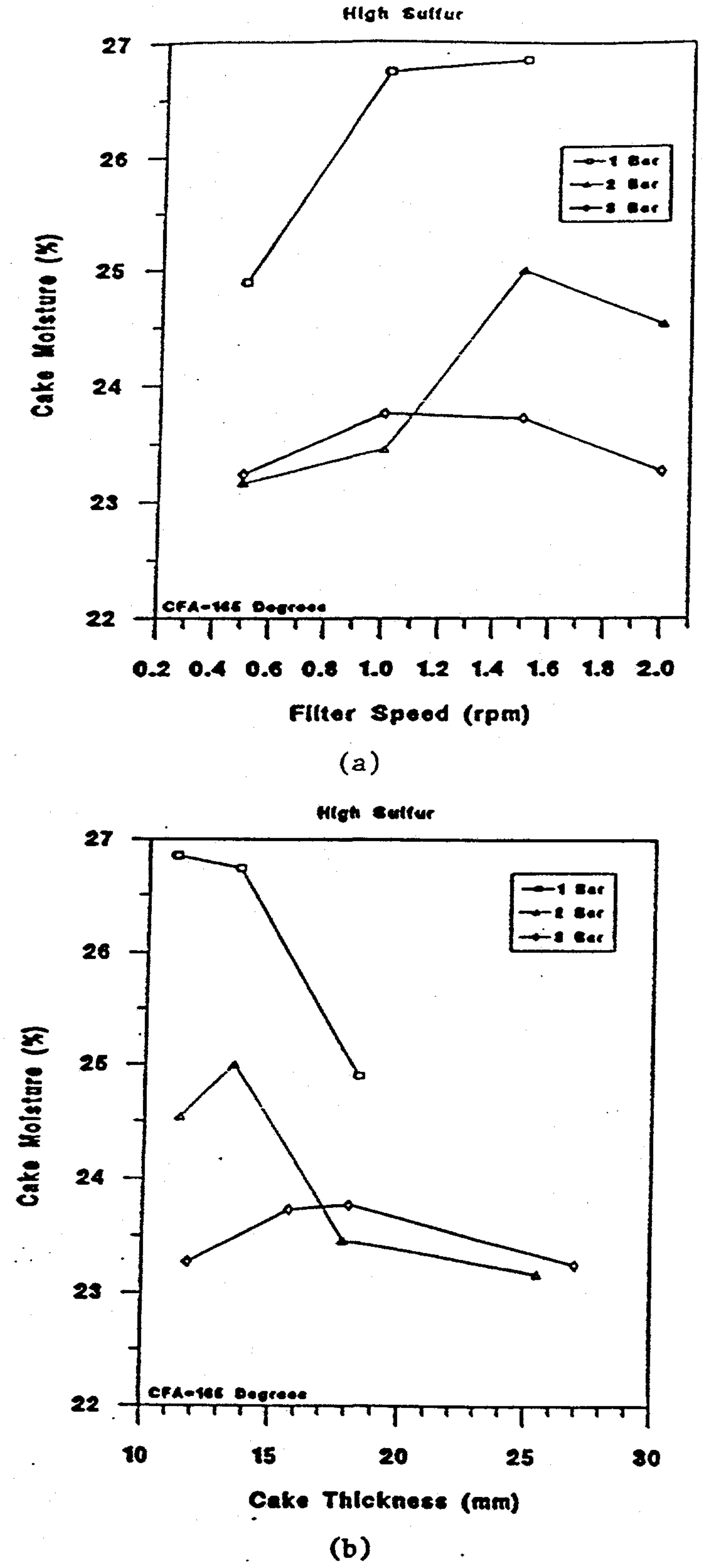


Figure 18. Effects of filter speed (a) and cake thickness (b) on cake moisture for pressure filtration of high sulfur coal at 165° cake formation angle at various vessel pressures

unexpected since the filter cake produced under these conditions were thin (Figure 16b). Also shown in Figure 16a is the effect of increasing pressure on cake moisture at a fixed CFA; not surprisingly, cake moisture was reduced with increasing pressure. When the CFA was increased to 125° (Figure 17a), similar results were obtained. At low pressure (1 bar), filter cake moisture shows slight decrease as cake thickness increased, however at higher pressures (2 and 3 bar), cake thickness had little effect on moisture. Again, increasing pressure reduced cake moisture. At the highest CFA of 165°, cake moisture increased with increasing filter speed as shown in Figure 18a. This was the case for both 1 and 2 bar pressures. However, at 3 bar, cake moisture remained essentially constant at 23.5% moisture.

The effect of CFA on cake moisture for various filter speeds (0.5, 1.0, and 1.5 rpm) is summarized in Figures 19, 20 and 21. These results show that as the CFA was increased, cake moisture also increased. As expected, cake moisture was reduced with higher pressures. One series of tests that were particularly noteworthy are shown in Figure 21 where the filter speed was maintained at 1.5 rpm. As the CFA was increased from 85° to 165°, the cake moisture obtained at 1 bar pressure increased from 24.8% to 27% moisture. At higher pressure (3 bar), the cake moisture increased from 21% to 23.7% over the same range of CFA. Further increasing the pressure to 5 bar did not provide additional moisture reduction, the moisture actually increased from 22% to 25%. These results show that there is no apparent benefit to using high pressure of 5 bar to remove moisture from this substrate under these conditions, a pressure of 3 bar appears to be sufficient.

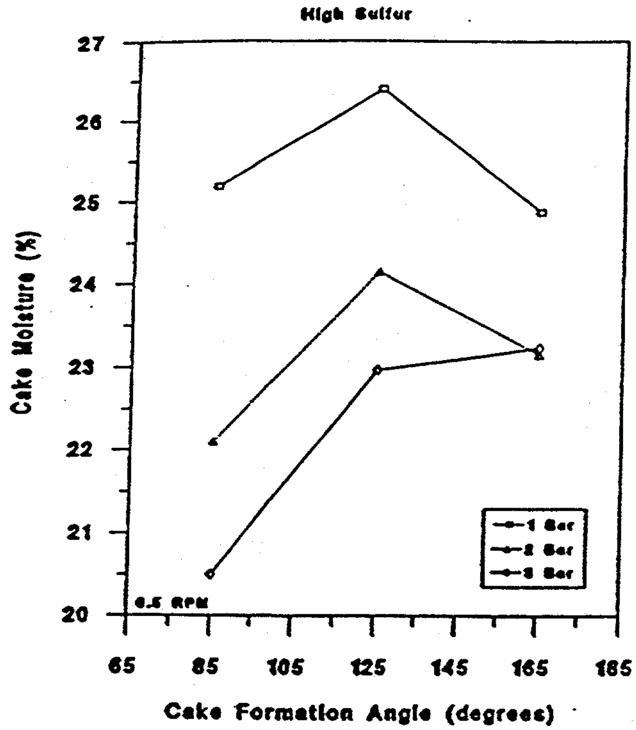


Figure 19. Effect of cake formation angle on cake moisture for pressure filtration of high sulfur coal at 0.5 rpm filter speed and various vessel pressures

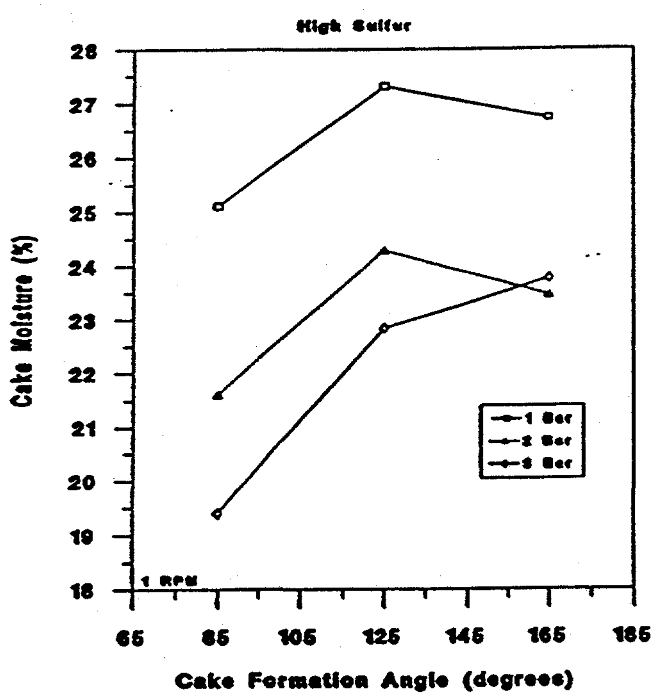


Figure 20. Effect of cake formation angle on cake moisture for pressure filtration of high sulfur coal at 1 rpm filter speed and various vessel pressures

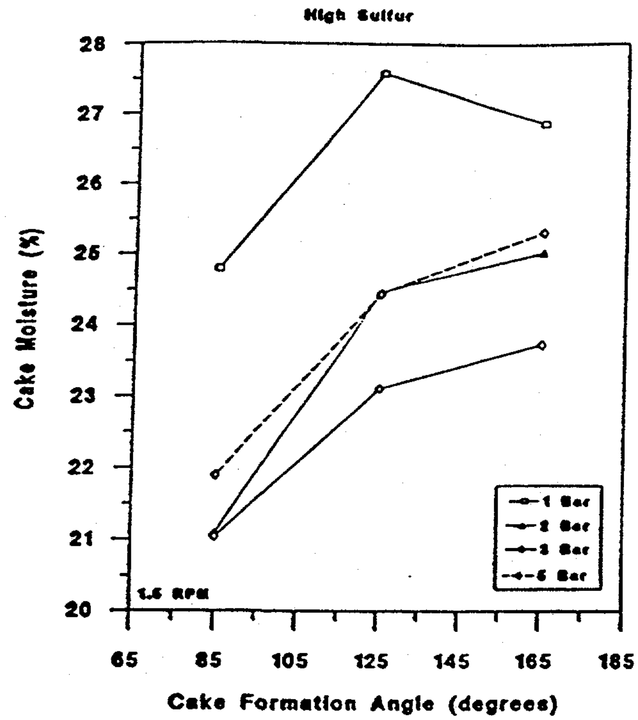


Figure 21. Effect of cake formation angle on cake moisture for pressure filtration of high sulfur coal at 1.5 rpm filter speed and various vessel pressures

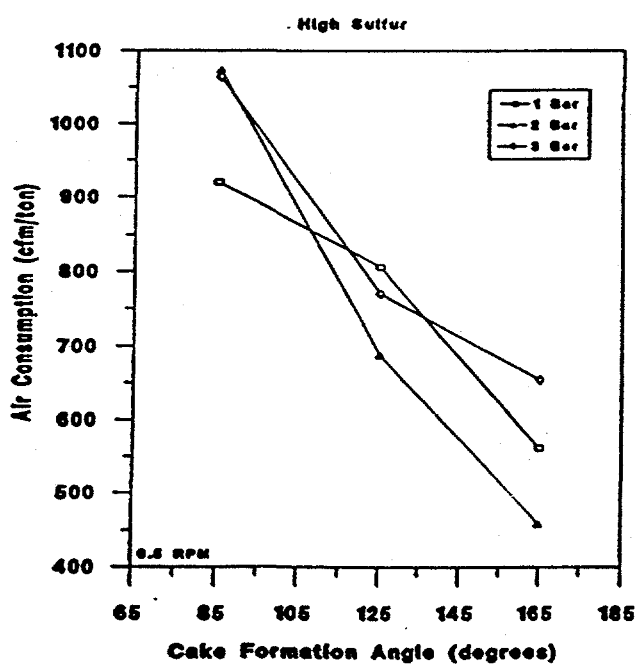


Figure 22. Effect of cake formation angle on air consumption for pressure filtration of high sulfur coal at 0.5 rpm filter speed and various vessel pressures

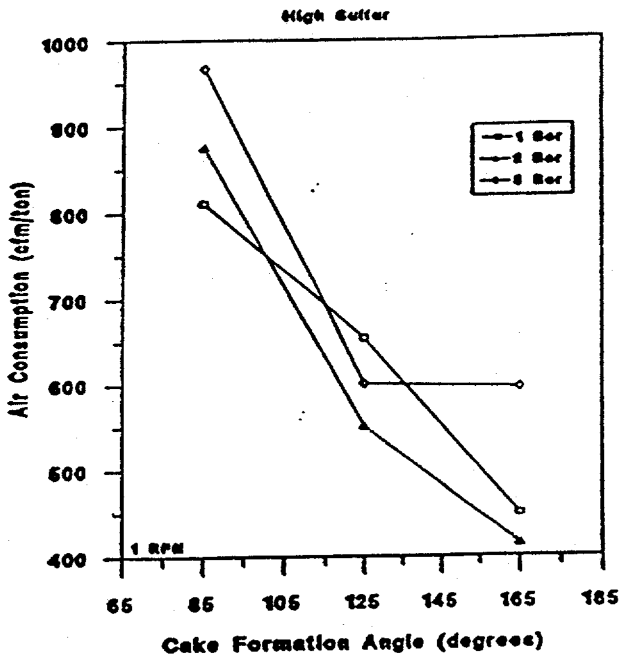


Figure 23. Effect of cake formation angle on air consumption for pressure filtration of high sulfur coal at 1 rpm filter speed and various vessel pressures

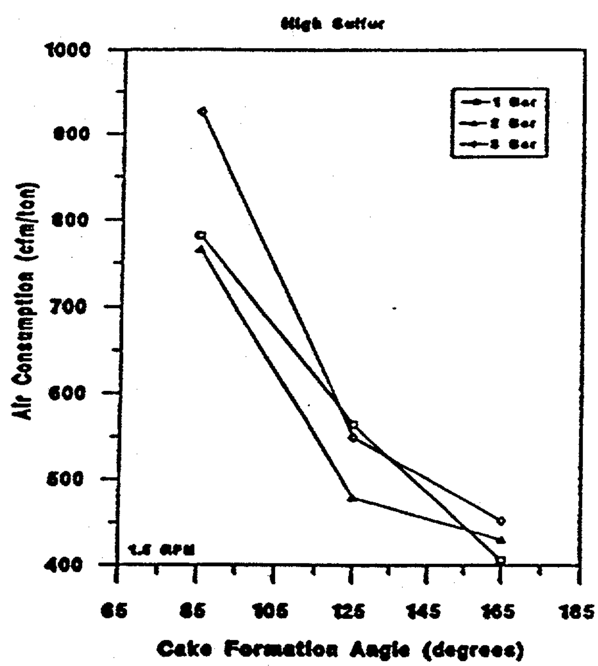


Figure 24. Effect of cake formation angle on air consumption for pressure filtration of high sulfur coal at 1.5 rpm filter speed and various vessel pressures

While it is evident from the results shown in Figures 19, 20 and 21 that lower cake moistures were obtained at lower CFA's, an important consideration is the air consumed to achieve these results. Figures 22, 23 and 24 show that as the CFA is increased, the air consumption decreases, regardless of the pressure used or the filter speed. The lowest air consumption requirements were for a CFA of 165°. At a filter speed of 1.5 rpm and a CFA of 165° (Figure 24), the air consumption for 3 bar pressure was 460 scfm/ton.

Another important consideration in measuring filter performance is the throughput which is summarized in Figures 25, 26 and 27. In general, throughput increased with both increasing CFA and increasing pressure. At one bar pressure, throughput was much lower regardless of CFA or filter speed. The highest throughputs obtained at this pressure were at a filter speed of 1.5 rpm where the throughput increased from 77 to 120 $lb/ft^2/hr$ as the CFA was increased from 85° to 165° (Figure 27). At 3 bar pressure, throughput was increased significantly from 110 to 165 $lb/ft^2/hr$ over the same range of CFA's.

Before summarizing baseline testing results, it is important to recognize that while it is desirable to reduce cake moisture to the lowest levels possible, it is also desirable to obtain these results with minimum cost (i.e. minimize air consumption and maximize throughput). With these factors in mind, the baseline test conditions selected from these results to minimize moisture and air consumption while maximizing throughput were:

3 bar pressure

1.5 rpm filter speed

165° CFA.

These conditions produced a filter cake with 23.6% moisture and a cake thickness of 18 mm. These conditions resulted in a solids throughput of 165 lb/ft^2/hr and an air consumption of 460 scfm/ton.

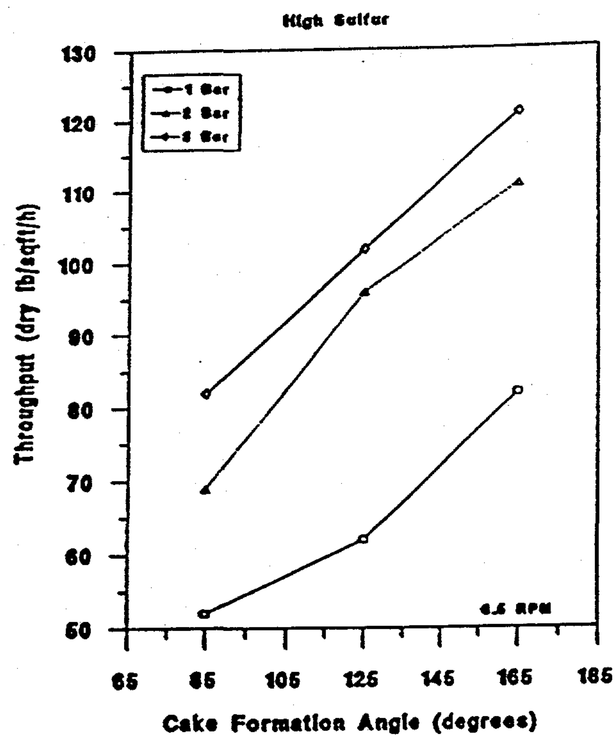


Figure 25. Effect of cake formation angle on throughput for pressure filtration of high sulfur coal at 0.5 rpm filter speed and various vessel pressures

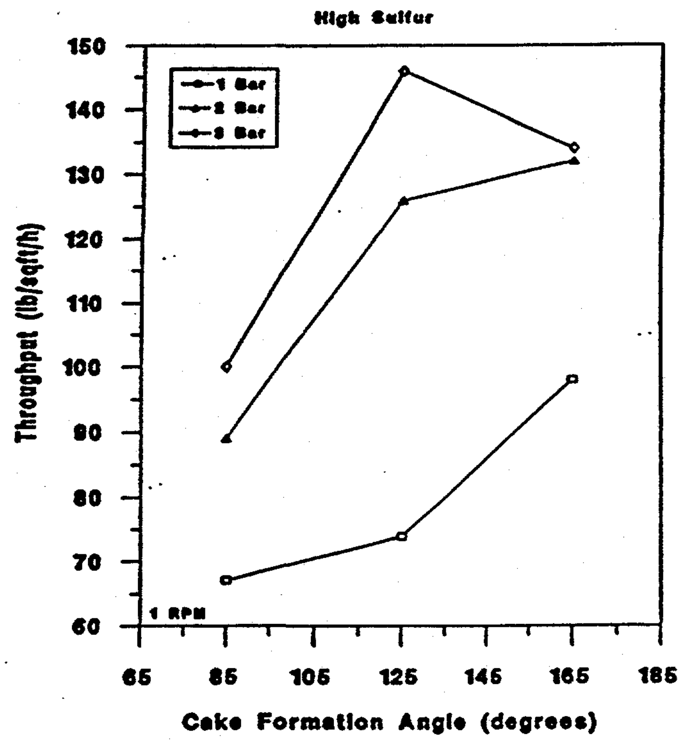


Figure 26. Effect of cake formation angle on throughput for pressure filtration of high sulfur coal at 1 rpm filter speed and various vessel pressures

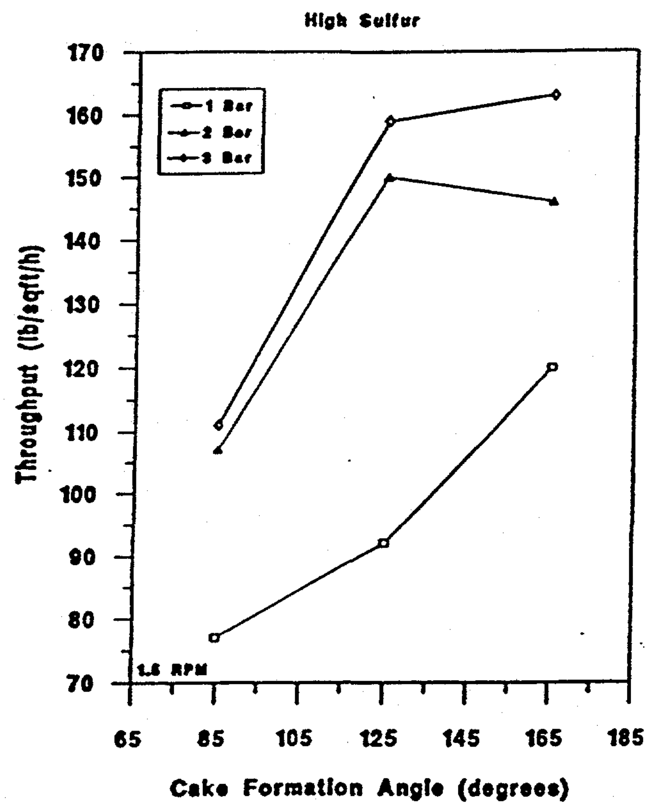


Figure 27. Effect of cake formation angle on throughput for pressure filtration of high sulfur coal at 1.5 rpm filter speed and various vessel pressures

ACTIVITIES FOR NEXT QUARTER

Analysis of the test data obtained with the Andritz hyperbaric unit will be completed. The laboratory dewatering studies in progress at the Andritz laboratory will be completed.

Paperwork for rental of a 3-ft. diameter vacuum drum filter will be completed and we plan to install the unit at the Mayflower Preparation Plant site by the end of June.

Laboratory dewatering tests using vacuum drum filter will be continued.