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**ENCOAL Mild Coal Gasification
Demonstration Project**

**Annual Report
October 1994 - September 1995**

January 1996

Work Performed Under Contract No.: DE-FC21-90MC27339

For
U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

By
ENCOAL Corporation
Gillette, Wyoming

MASTER

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P.O. Box 880
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INTRODUCTION

This document is the combination of the fourth quarter report (July - September 1995) and the 1995 annual report for the ENCOAL project. The following pages include the background and process description for the project, brief summaries of the accomplishments for the first three quarters, and a detailed fourth quarter report. Its purpose is to convey the accomplishments and current progress of the project.

BACKGROUND INFORMATION

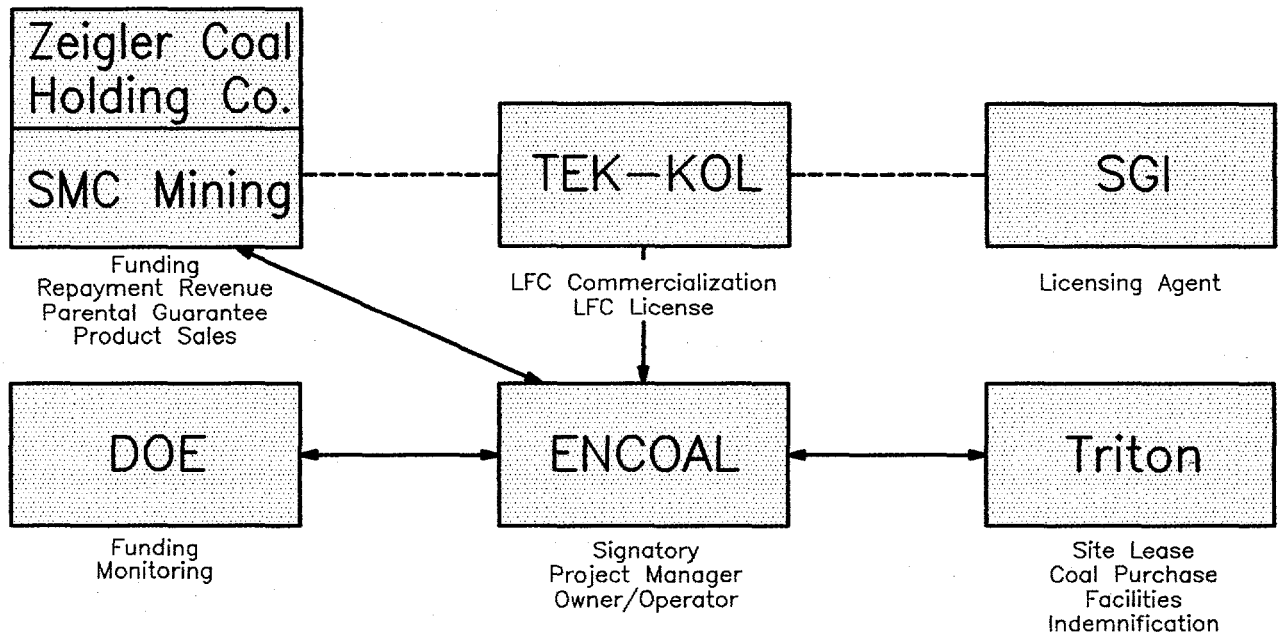
ENCOAL Corporation, a wholly-owned subsidiary of SMC Mining Company (formerly Shell Mining Company, now owned by Zeigler Coal Holding Company), has completed the construction and start-up of a mild gasification demonstration plant at Triton Coal Company's Buckskin Mine near Gillette, Wyoming. The process, using Liquids From Coal (LFC) technology developed by SMC and SGI International, utilizes low-sulfur Powder River Basin coal to produce two new fuels, Process Derived Fuel (PDF) and Coal Derived Liquids (CDL). The products, as alternative fuels sources, are expected to significantly lower current sulfur emissions at industrial and utility boiler sites throughout the nation, thereby reducing pollutants causing acid rain.

ENCOAL submitted an application to the U.S. Department of Energy (DOE) in August, 1989, soliciting joint funding of the project in the third round of the Clean Coal Technology Program. The project was selected by DOE in December, 1989 and the Cooperative Agreement approved in September, 1990. Construction, commissioning, and start-up of the ENCOAL mild coal gasification facility was completed in June of 1992. On July 17, 1994, ENCOAL requested a two-year extension of the Cooperative Agreement with the DOE that will carry through September 17, 1996. Some plant modifications have been required as discussed below.

PROJECT ORGANIZATION OVERVIEW

ENCOAL is the participant with the DOE and the signatory to the Cooperative Agreement and is the owner, manager and operator of the demonstration plant. ENCOAL is responsible for all aspects of the project, including design, permitting, construction, operation, data collection and reporting. ENCOAL managed the design and construction of the project through a project manager, who was assisted by a team of technical and managerial personnel. The engineering, procurement and construction of the plant was contracted to The M. W. Kellogg Company. Coal that is processed during plant operation is purchased from the site host, Triton Coal Company. Triton also provides access to the site, associated facilities and infrastructure vital to the project and administrative services. Equity funding, administrative services, and product marketing services for the project are provided by service subsidiaries of Zeigler Coal Holding Company. Additional technical development support is provided by TEK-KOL, which also has the primary responsibility for commercialization. All assets are assigned to ENCOAL, while all technology rights are held by TEK-KOL and licensed to ENCOAL. (*See Figure 1: ENCOAL Project Organization*)

Figure 1. ENCOAL Project Organization



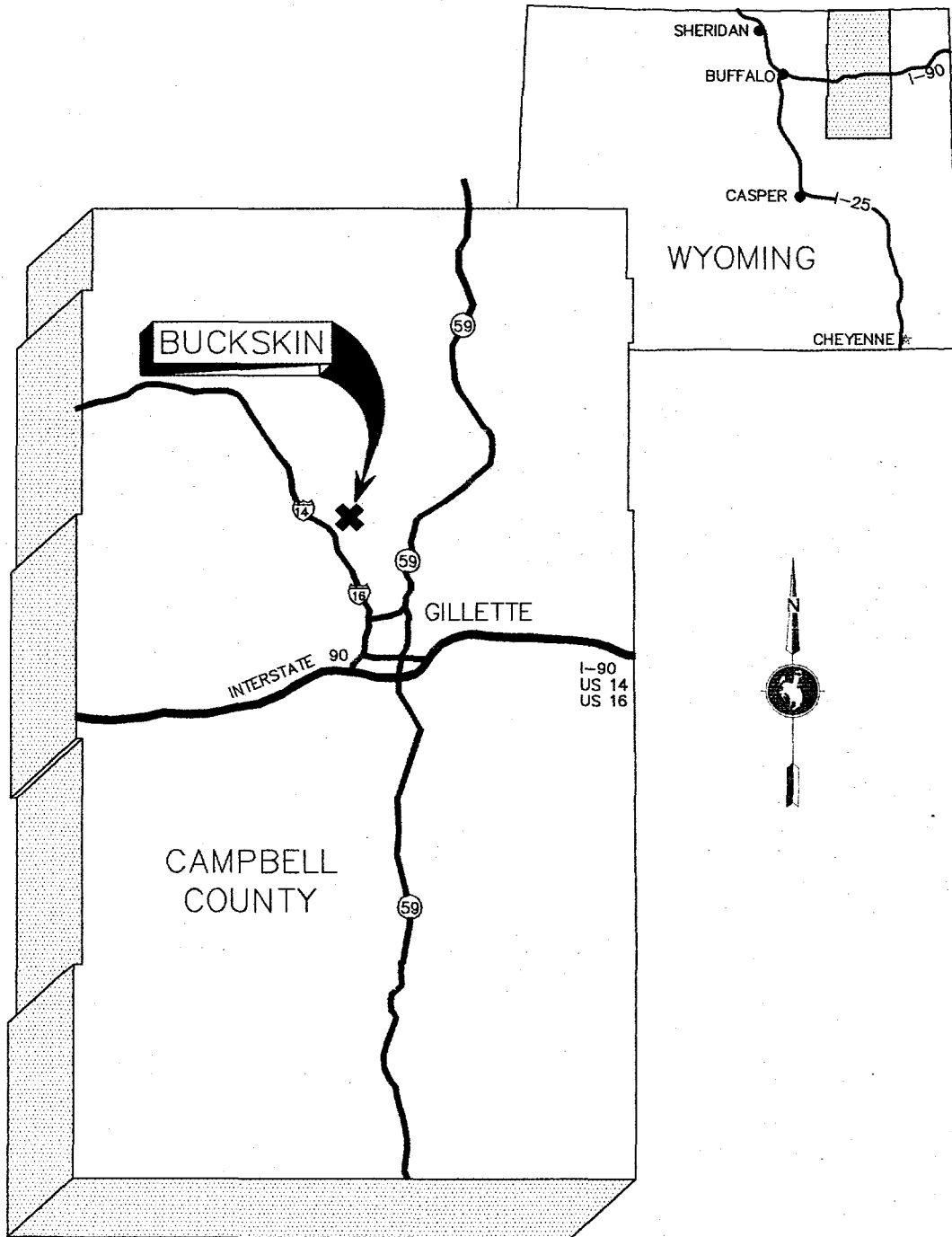
LOCATION

The demonstration plant site is located in Campbell County, Wyoming, approximately ten miles north of the county seat of Gillette. (See Figure 2: ENCOAL Project Location). The site is within the Triton Coal Company's, (a wholly owned subsidiary of SMC Mining Company), Buckskin Mine boundary, proximal to the mine's rail transportation loop. Active coal mining and reclamation operations surround the demonstration plant site.

PROCESS CONCEPT

The LFC technology uses a mild pyrolysis or mild gasification process which involves heating the coal under carefully controlled conditions. The process causes chemical changes in the feed coal in contrast to conventional drying, which leads only to physical changes. Wet subbituminous coal contains considerable water, and conventional drying processes physically remove some of this moisture, causing the heating value to increase. The deeper the coal is physically dried, the higher the heating value and the more the pore structure permanently collapses, preventing resorption of moisture. However, deeply dried Powder River Basin coals exhibit significant stability problems when dried by conventional thermal processes. The LFC process overcomes these stability problems by thermally altering the solid to create PDF and

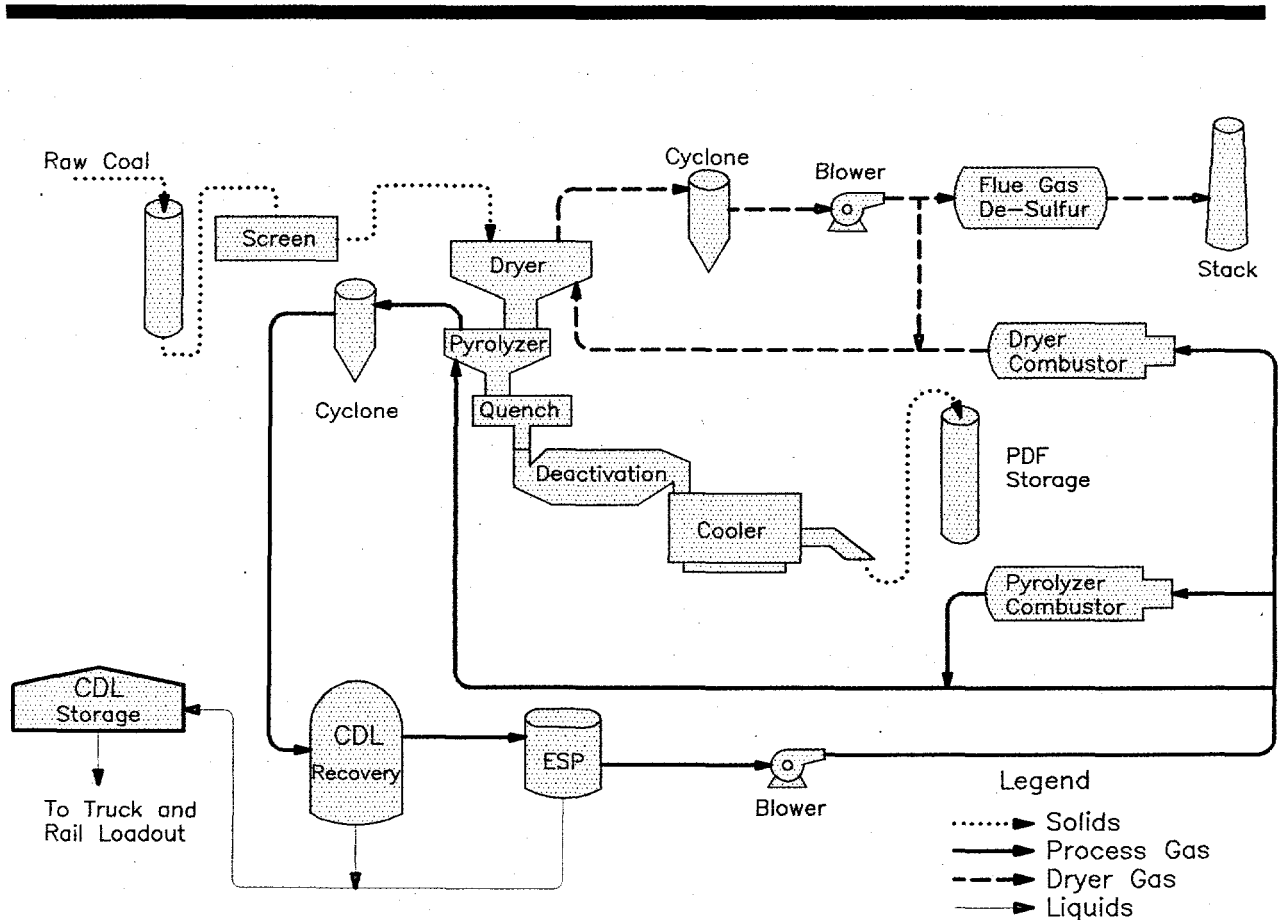
Figure 2. ENCOAL Project Location



CDL. Specification PDF is a stable low sulfur, high BTU fuel similar in composition and handling properties to bituminous coal. CDL is a heavy, low sulfur hydrocarbon liquid that can be used as an industrial fuel or perhaps upgraded for chemical feed stock or transportation fuels. Briefly, in the LFC technology, coal is first deeply dried to remove water physically. The temperature is further raised in a second stage which results in decomposition reactions that form the new products. This chemical decomposition (mild gasification) creates gases by cracking reactions from the feed coal. The chemically altered solids are cooled and further processed to make PDF. The gases are cooled, condensing liquids as CDL, and the residual gases are burned in the process for heat. The process release for the ENCOAL plant predicted that one ton of feed coal would yield roughly 1/2 ton of PDF and 1/2 barrel of CDL. By varying plant running conditions, however, it has since been learned that the actual CDL recovery rate may be as much as 15% to 20% above the projections.

Figure 3 is a simplified flow diagram of the ENCOAL process. Run-of-mine coal is supplied to the demonstration plant from existing Buckskin Mine storage silos. The coal is transferred periodically to a new 3000-ton storage silo. Coal from this silo is sized by crushing and screening to 2" X 1/8", continuously fed (up to 1000 ton/day) onto a conveyor belt by a vibrating feeder and lifted about 195 feet to the top of the plant building (the entry point to the dryer on Figure 3).

Figure 3. Simplified Process Flow Diagram

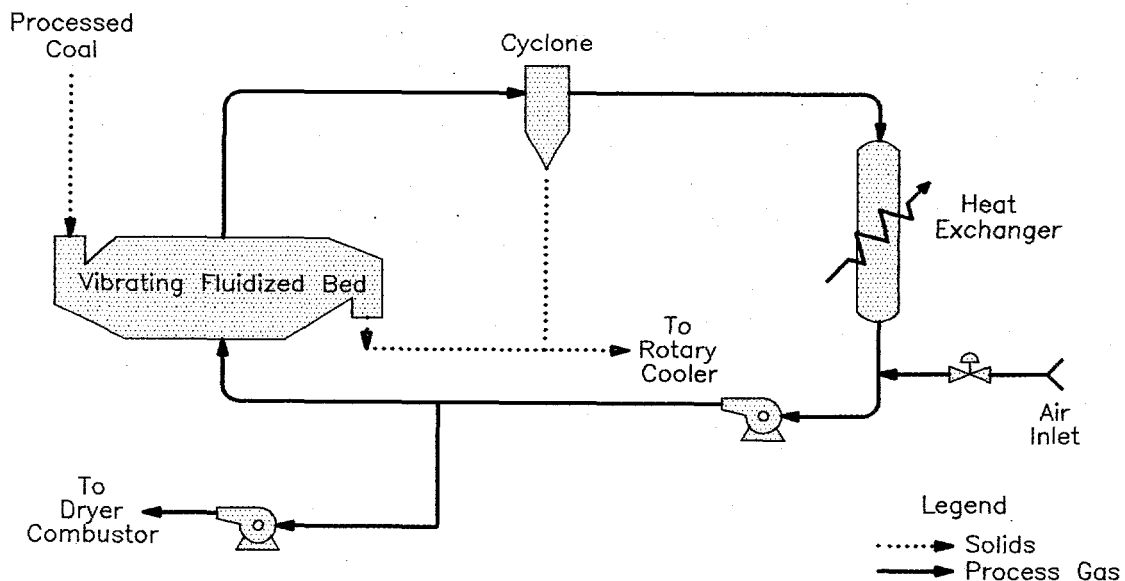


The coal is then fed into a rotary grate dryer where it is heated by a hot gas stream. The residence time and temperature of the inlet gas have been selected to reduce the moisture content of the coal without initiating pyrolysis or chemical changes. The solid bulk temperature is controlled so that no significant amounts of methane, carbon monoxide, or carbon dioxide are released from the coal.

The solids then report to the pyrolyzer where the temperature is further raised to about 1000 °F on another rotary grate by a hot recycled gas stream. The rate of heating of the solid and its residence time are carefully controlled as these parameters affect the properties of both products. During processing in the pyrolyzer, all remaining free water is removed and the chemical reactions occur. After leaving the pyrolyzer, the solids are quickly cooled to stop the pyrolysis reactions.

The processed coal is then fed into the deactivation loop where it is partially fluidized and treated with a controlled temperature and oxygen gas stream in a vibrating fluidized bed, (VFB), unit. The deactivation gas stream consists of a blower to move the gas stream, a cyclone to remove entrained solid fines, a heat exchanger to control gas temperature, and a booster blower to bleed off gas to the dryer combustor. (See Figure 4: PDF Deactivation Loop Simplified Process Flow Diagram) The residence time, oxygen content, and temperature of the gas stream have been selected to deactivate the coal within the VFB unit.

Figure 4.
PDF Deactivation Loop Simplified Process Flow Diagram



Once treated in the VFB, the solids exit the deactivation loop and are further cooled and transferred to a surge bin. Since the solids are dusty, having no surface moisture, they require dust suppression. A very effective dust suppressant patented by SMC Mining Company, called MK, is added to the solid product as it leaves the surge bin. The resulting new fuel form is now called PDF. It is transferred to storage silos where it is held for shipment by rail through existing Buckskin loadout facilities.

In the liquids recovery section of the plant, the pyrolysis gas stream leaving the pyrolyzer is cooled in a quench tower to stop any additional pyrolysis reactions and to condense the desired hydrocarbons. The gas temperature is kept above the dew point of the water so that only CDL is condensed. This step prevents the formation of water in the process and the resulting separation and disposal problems.

Most of the residual gas from the condensation unit is recycled to the pyrolyzer by a blower. Some of this gas is burned in the pyrolyzer combustor and blended with the recycled gas which provides heat for the pyrolyzer.

The remaining gas is burned in the dryer combustor which converts all sulfur compounds to sulfur oxides. Nitrogen oxide emissions are controlled by appropriate design of the combustor, based on evaluation of NO_x control technologies for low BTU gases. The hot flue gas is blended with the recycle gas from the dryer to provide heat and gas flow necessary for drying. The exhaust gas from the dryer gas loop is treated first in a wet scrubber followed by a horizontal scrubber, both using a water-based sodium carbonate solution. The wet gas scrubber recovers fine particulates that escape the dryer cyclone and the horizontal scrubber removes most of the sulfur oxides from the flue gas. The spent solution discharges into a clay lined pond for evaporation.

PROJECT DESCRIPTION

The ENCOAL project involves the design, construction and operation of a 1000 ton per day mild coal gasification demonstration plant and all required support facilities. A significant reduction in work scope and cost is being realized on the project due to the existence of the host Buckskin Mine. Coal storage and handling facilities, rail loadout, access roads, utilities, office, warehouse and shop facilities are all present at the mine site and thus reduce the need for new facilities for the ENCOAL project. Operations staff, supervision, administrative services and site security are being provided under contract with Triton Coal Company. The balance of the project requirements are being provided by ENCOAL and its subcontractors.

The project is divided into three phases as follows:

Phase I -- Design and Permitting

Phase II -- Construction and Start-up

Phase III -- Operation, Data Collection, and Reporting

Two budget periods encompass the work, the first covering Phases I and II and the second covering Phase III. A typical Work Breakdown Structure has been developed for the project.

Engineering, procurement and construction management (EPC) for the project was handled by The M.W. Kellogg Company. Kellogg's scope of work included home office design, project coordination, field construction supervision, scheduling, project controls, procurement and project management.

ENCOAL and Triton are handling the operations planning, training, maintenance planning, staffing, plant commissioning and start-up, data gathering and plant operation. Other than the actual plant operation, many of these activities took place in Phase II. Preparation of written plans and manuals was also a part of these activities. All permitting requirements were handled by ENCOAL, and field engineering and construction support was handled by ENCOAL's technical team. ENCOAL submitted its Continuation Application to the DOE on May 17, 1992, and the ENCOAL plant is currently operating under Phase III of the project.

INTERFACE WITH BUCKSKIN MINE PLANT EXPANSION

The Buckskin Mine plant expansion project commenced construction in 1990 adjacent to the ENCOAL project site. Construction of the expansion was completed in January 1993 and the new facilities are currently in operation. The expansion allows the mine to eventually increase coal production to 20 million tons per year and consists of three new 12,000 ton silos, an automated batch loadout facility, a transfer tower, and an in-pit hopper with associated conveyors.

The decisions and approvals of the Buckskin Mine project were made independent of and subsequent to ENCOAL's Cooperative Agreement with the DOE. The interface and proximity of the ENCOAL project and the plant expansion provided optimization opportunities for ENCOAL, but also required changes in some instances from ENCOAL's original plans. Examples were changes in grade elevations, moving conveyor supports, use of existing MCC buildings, and moving temporary construction facilities.

MAJOR PLANT MODIFICATION -- PDF DEACTIVATION FACILITIES

Problems with PDF product self heating in 1992 and 1993 led to several minor plant modifications and extensive testing in hopes of using original plant equipment to produce stable PDF. Results of a January 1993 test run, however, indicated that PDF deactivation would require a separate, sealed vessel. Subsequent plant and laboratory tests were run in February and March of the same year in order to establish effective criteria for deactivation. Based upon the results of these tests, an option for PDF deactivation was chosen. The deactivation process is discussed above and is shown in Figure 4. For the modification, a 6'X30' vibrating fluidized bed unit and support equipment were installed in series with the original plant equipment. Installation of the PDF deactivation facilities, (*ie VFB project*), began in June 1993 adjacent to the ENCOAL plant. Construction and start-up of the facilities was completed in January 1994 and the new equipment is currently in operation.

EXECUTIVE SUMMARY FOR QUARTERS 1, 2, AND 3 -- October 1994 through June 1995

During the first three quarters, ENCOAL's primary objective was the continuous production of stable PDF for test burn shipments. ENCOAL conducted four runs during the period, the last of which was still in progress on June 30th. Plant operating conditions were varied extensively while attempting to produce stable PDF using in-plant equipment during this period. However, the PDF produced still required additional finishing outside the plant using pile layering and blending techniques. Approximately 9,000 tons of stable PDF was produced during the months of October 1994 through June 1995 using these methods.

ENCOAL shipped a total of ten trains containing PDF and ROM coal blends during the first three quarters. The blends ranged from 24 to 90.7 percent PDF and were shipped to three separate customers, (*Western Farmers Electric Cooperative, Muscatine Power and Water, and Omaha Public Power District*). The total amount of PDF shipped was 34,430 tons. PDF inventory at the end of June was approximately 1,500 tons.

CDL product quality showed some improvement during the period. Early 1995 process changes decreased the percent water and solids, and increased the heating value. Over 26,200 barrels of CDL were shipped by the end of June and shipments were being made routinely as CDL became available. ENCOAL also initiated compatibility and CDL characterization studies to further evaluate CDL quality and marketability. Initial indications revealed promising economics for recovering coal tar acids and transportation grade fuels.

Several plant operability and safety projects were also completed by the end of June 1994. These included: 1) installation of a dryer grate water seal; 2) additional insulation on the pyrolyzer loop ductwork; 3) installation of a small stand-by steam boiler; 4) construction of a nitrogen membrane system; 5) expansion of the control room building facilities; 6) installation of a waste water return system; and, 7) construction of a permanent process water fines removal facility. These projects were necessary to ensure the safe and efficient continuous operation of the ENCOAL plant.

I. FIRST QUARTER ACCOMPLISHMENTS - October through December 1994

3.0 PHASE III -- OPERATION, DATA COLLECTION, AND REPORTING

ENCOAL concentrated on plant operation, PDF stabilization and plant operability projects during the quarter. Work also continued on equipment maintenance, and the design of a permanent process water fines handling system. Two runs were conducted during the period, for a total of 58 days of plant operation. Variation of plant operating parameters continued in both runs to improve in-plant deactivation. However, the PDF produced still had to be stabilized by pile layering, blending with ROM coal, or blending with previously stabilized PDF prior to being stored in silos for test burn shipments. Approximately 25,000 tons of stabilized PDF was produced by these methods by January 1, 1995.

ENCOAL shipped six trains containing 21,732 tons of PDF during the months of October through December 1994. Three of the trains went to Western Farmers Electric Cooperative in Hugo, Oklahoma, and the remaining three trains were sent to Muscatine Power and Water in Muscatine, Iowa. The trains contained various blends of PDF and ROM coal, (*ranging from 24.0% PDF up to 90.7% PDF*), for test burns in these utility boilers. The last train sent to Muscatine Power and Water containing the 90.7% PDF represented ENCOAL's first shipment of a full unit train of PDF. This train was essentially 100% PDF with a cap of run-of-mine coal to prevent fines losses during shipment. The PDF shipped exhibited no handling, dustiness, or self-heating problems.

CDL shipments continued with a total of twenty-six railroad tank cars being shipped during the quarter. These tank cars were sent to several new customers for test burn and compatibility testing, and to Dakota Gas, (*located in Beulah, North Dakota*), the primary customer for the oil. ENCOAL also started compatibility and CDL characterization studies to develop future CDL markets.

Good progress was made on the procurement and installation of the new process water fines handling system. The new system uses a clarifier/thickener, vacuum filter, and a simple drain system to gather all the process water slurries, settle out the fines, and recirculate clear water back to the plant. Bid packages for the facility's clarifier, vacuum filter, steel building, equipment support steel, building foundations, heater, pumps, and other utility equipment were all issued and awarded during the quarter. The foundations contractor was 70% complete by quarter's end, and erection of the equipment and steel building was scheduled to begin in early February 1995. Good progress was also made on the installation of the dryer grate water seal. Work on the seal was approximately 50% completed at the end of the quarter. This included demolition of the original sand seal, installing new supports for the roof, and cutting the opening in the vessel wall.

ENCOAL received approval from the DOE for a two year extension of the Cooperative Agreement in October 1994. The approval was in response to a request for a contract extension filed in July 1994. The two year extension continues the DOE participation in the project through September 17, 1996.

Significant visitors to the site during the quarter included the following:

Four Japanese officials, including representatives from The Electric Power Development Company (*EPDC*) where a laboratory test burn of PDF has been conducted. These representatives were:

- Mr. Okamoto - Manager of Coal Industry Division MITI, (*Ministry of International Trade and Industry*)
- Mr. Takagi - Director of CCUIJ, (*Center for Coal Utilization, Japan*)

Mr. Hirai - Deputy Director of Thermal Power
Department EPDC
Mr. Haruna - Manager Engineering Development Section,
Thermal Power Department EPDC

A group from P.T. Bureau, an Indonesian Mining Company
Both groups were given a presentation and a tour of the project.

There were no lost time or reportable accidents on the project this quarter, and ENCOAL achieved 717 days without a lost time accident (LTA). The project underwent one state inspection and one environmental inspection, and received no NOV's (*Notice of Violation*) or citations. The project also underwent an MSHA AAA inspection during the quarter and received one citation for not having an electrical inspection record for a small fabrication shop located near the ENCOAL facilities.

II. SECOND QUARTER ACCOMPLISHMENTS - *January through March 1995*

3.0 PHASE III -- OPERATION, DATA COLLECTION, AND REPORTING

ENCOAL concentrated on plant operation, PDF stabilization, and plant operability projects during the quarter. One plant run was conducted beginning on February 25th and was still in progress on March 31st. A new record was achieved in March by processing 13,714 tons of raw coal in a one month period, beating the previous record by over 900 tons. Plant operation was smooth overall, and the plant availability for the run was 89%. A major source for downtime was an intentional 44-hour outage to remove and replace the original quench table heat exchanger, (R_2D_2), with the newly purchased, high capacity units. A one week long training session was held in January to improve staff and technician's knowledge of the process and changes to plant systems. Plant operators also began gathering data on approximately 380 plant components for input into the new Zeigler EMS (*Equipment Management System*) maintenance program. This new system is now on line and will be used to develop a work order system, preventative maintenance scheduling, and equipment operating data collection.

Variation of the plant operating parameters continued in an attempt to improve in-plant deactivation of PDF. The key parameters were higher bed temperatures in the VFB system to increase the amounts of oxygen applied to the PDF, raising of the VFB solids discharge weir to increase the residence time in the VFB unit, and improvements in the operation of the quench table to reduce water carry over to the VFB gas loop. None of the plant run PDF from these tests was able to pass an un-compacted pile stability test. The PDF produced was stabilized by pile layering and then blended with plant run PDF and stored in silos for test burns. Approximately 7,000 tons of stabilized, 10,700 BTU PDF was produced in this manner during the months of January through March 1995.

CDL inventory at the end of the quarter was 9,643 barrels with fifteen railroad tank cars, (7,650 bbls), being shipped to Dakota Gas. CDL quality improved as early 1995 process changes decreased the percent water and solids, and increased the heating value. The compatibility and CDL characterization studies continued to further understand CDL quality and potential markets. Initial indications revealed promising economics for recovering coal tar acids and transportation grade fuels. A feasibility review of proven recovery processes available in the industry was planned to begin when the studies were complete. CDL samples were sent to several separate consultants and laboratories to perform this work.

A Technical Review meeting was held on February 9th and 10th to discuss the status of the PDF stabilization efforts and the operation of the plant. Attendees of the meeting included representatives of SGI International, the Department of Energy, the ENCOAL technical staff, and plant operators. Data collected during October 1994 through January 1995 plant operation was discussed and reviewed. Results of the discussions lead to the drafting of a special run plan to begin in late February 1995. In particular, new plant operating parameters affecting the VFB system were recommended to aid in the "in-plant" stabilization of PDF. (*See section 3.0, paragraph 2 above*).

Bench scale testing for PDF stabilization also continued at the SGI Development Center in Perrysburg, Ohio. This work was in support of the design of additional or alternative equipment that could be installed in the demonstration plant to achieve in-plant deactivation of PDF. Much of this work involved the study of the "cascade deactivation" approach to obtain PDF stability. This concept exposes reactive PDF to a series of controlled temperature and oxygen gas streams, with each successive step being lower in temperature and higher in oxygen content than the previous step, until a stable PDF product is obtained. A new circular grate design for implementing the cascade deactivation approach was reviewed in the February technical meeting. A design basis document for this circular grate and a test plan for pilot scale testing was developed, and a 500kg sample of non-deactivated PDF was collected and sent to Mitsubishi Heavy Industries (MHI) in Japan for testing in a pilot cascade deactivation unit. A representative was sent to Japan in March to review the test procedures and to observe the testing of the non-deactivated PDF sample. However, it was determined that modifications would be necessary to the pilot unit prior to running the tests, and testing was re-scheduled for June 1995. Costs for this laboratory testing and equipment development were not DOE shared.

ENCOAL commenced work on a commercial plant cost and economics study in March 1995. Both a project definition and timeline schedule were developed, and areas of review were to include plant design, capital costs, operating costs, CDL and PDF marketing, and overall costs and economics of a commercial venture.

Good progress was made on the construction of the new process water handling system. The building siding, insulation, and liner panel was installed, and the clarifier was approximately 98% complete by quarter's end. Installation of the utility piping, electrical power and control, and the building roof was expected to commence in April. Construction of the facility was scheduled to be complete in May 1995. (See Figure 5: Process Water Clarifier set in place.)

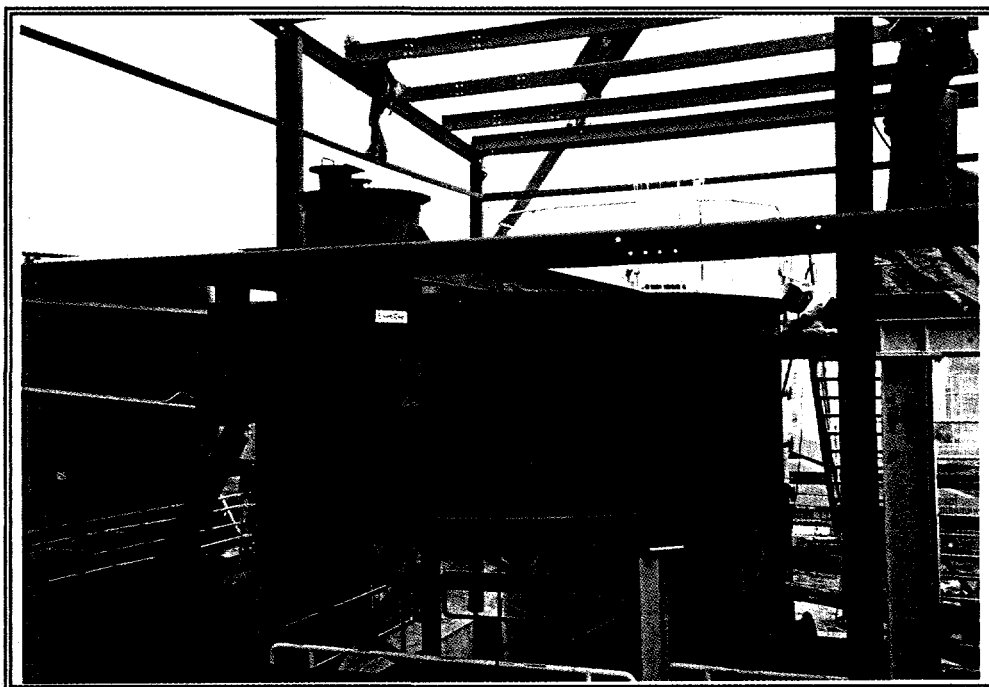


Figure 5: Process water clarifier set in place.

Good progress was also made on the control room building expansion. Bids for the project were received and awarded in January 1995, and construction was initiated in February. This expansion was necessary to provide a larger training/lunchroom area, additional office space, storage for plant safety equipment, a maintenance office/library, and a personnel changing area.

Significant visitors to the site during this period consisted of governmental and industrial representatives from the Kemerova mining district of Russia as follows:

- Mr. Igor A. Korobetski - Managing Director International Center for Coal Research
- Mr. Valery E. Zaidenvarg - First Deputy Director General, Rosugol Company
- Mr. Peter A. Levin - Director, General International Mining Association Intermin

Other significant visitors included three representatives of Mitteldutsche Braunkohlengesellschaft mbh (MIBRAG), a German mining company that mines 20 million tons of brown coal annually, and their consultants. Both groups were given a presentation on the process and a tour of the plant.

There were no lost time or reportable accidents on the project this period, and ENCOAL achieved 806 days without a LTA. A dinner celebrating two years without a LTA was held on January 20th. ENCOAL also underwent a State of Wyoming mine inspection during the quarter, with only minor housekeeping items being recommended.

III. THIRD QUARTER ACCOMPLISHMENTS - April through June 1995

3.0 PHASE III -- OPERATION, DATA COLLECTION, AND REPORTING

ENCOAL concentrated on plant maintenance, construction of plant modifications, plant operation, CDL characterization, and commercial plant studies during the quarter. The plant was plagued with numerous start-up problems during the month of June, however, two plant runs were still conducted; one a continuation of a run started on February 25th, and one a run initiated on May 31st. Between these two operation periods, the plant was shut down for eight weeks to complete the installation of the process water fines handling system and a long list of miscellaneous plant change and maintenance items. Over 5,000 tons of stabilized PDF, and nearly 247,000 gallons of CDL were produced.

The PDF produced during the quarter continued to be stabilized by pile layering and then blended with plant run PDF prior to being stored in silos for test burn shipments. A total of four trains of PDF and ROM coal blends, (*one train to Muscatine Power and Water, and three trains to Omaha Public Power District, OPPD*), were shipped. The blends ranged between 24 to 33 percent PDF, and totaled 12,698 tons of PDF. PDF inventory at the end of June was 1,500 tons.

ENCOAL also attempted to produce a "higher" sulfur PDF for a test burn with Muscatine Power and Water in Muscatine, Iowa this quarter. Muscatine requested 6000 tons of PDF with greater than 1.5 lbs SO₂/MMBtu in order to meet specific requirements for their scrubber and precipitator operation. High sulfur coal was selectively mined for this processing. However, when this high sulfur coal was processed, such a significant amount of sulfur was removed that the PDF produced was below the Muscatine specification. (*NOTE: The ROM feed coal averaged 1.9 lbs SO₂/MMBtu while the PDF produced averaged 1.3 lbs SO₂/MMBtu, indicating an average loss of 0.6 lbs SO₂/MMBtu per ton of feed coal processed.*) The Muscatine test burn production was therefore deferred to July 1995 when higher sulfur ROM coal would be available for processing.

Eleven tank cars of CDL were shipped to Dakota Gas, and CDL inventory at the end of June was 389,000 gallons. ENCOAL continued studies on CDL compatibility, characterization, and upgrading this quarter. A thorough CDL characterization was completed by Dakota Gas in late June, and a kick-off meeting was held with Kellogg to initiate technical feasibility studies of various upgrading processes.

A technical review meeting was held on April 18th and 19th to review project challenges and to discuss long range objectives. Representatives from ENCOAL staff, SGI International and selected consultants attended. A special task force was established as a result of this meeting to solve the remaining PDF stabilization issues. The primary objective for this stability task force was to develop an acceptable in-plant stabilization method and to test it in the ENCOAL plant. This method was to be developed in parallel with the ongoing COD work at MHI and the SGI Development Center.

Representatives of the ENCOAL stability task force met with PETC and METC in May to outline areas where assistance is needed in solving PDF stability problems. During this meeting, extension of the existing CRADA, (*Cooperative Research and Development Agreement*), with PETC was discussed. By the end of June, documentation extending the CRADA was nearly complete. This project was to be a combined research effort involving ENCOAL, Western Syncoal, PETC and METC to develop measurement methods, define reaction kinetics and mechanisms, and develop new stabilization techniques. The primary goal was to solve the stability problems associated with upgraded PRB coal. Progress was also made in developing a reliable test to measure product reactivity. A modified Bureau of Mines test, (*nick-named Jar-O-R*), was tried on ENCOAL PDF, and was determined to be effective as a relative reactivity indicator. This test has proven to be a reliable test to measure the oxygen appetite of upgraded PRB coal.

ENCOAL continued work on a commercial plant cost and economics study. The heat and material balance for the commercial plant design was completed, and work on the material handling, cogeneration concepts, equipment selection, and site infrastructure began. A marketing study for PDF was completed and process evaluations were also in progress on the CDL upgrading options to determine commercial feasibility. The commercial plant work was scheduled for completion in late 1995.

Seven geotechnical survey holes were drilled on the preferred site for the permanent ENCOAL precipitate disposal pond in May. Results of core sample testing indicated that the soils in the area were acceptable for the pond construction site. Several design options for the pond were considered, and the selected option was reviewed with the WDEQ at a meeting in June. Using their input, the permit application was finalized for submittal to the WDEQ. WDEQ determined that public notice would be required, so construction of the pond in late 1995 became impossible. As a result, evaluation of options to extend the life of the temporary pond until construction of the permanent pond could be completed was initiated by ENCOAL.

Start-up of the process water handling system was accomplished in June. The clarifier successfully removed coal fines from the water, and the vacuum filter effectively produced a damp filter cake from the fines. The filter cake was found to be "dry" enough to allow the fines to be taken straight to a land farm for hydrocarbon treatment. (See Figures 6 and 7 - Process water fines handling system photos.)



Figure 6: Process water fines handling building under construction.

The control room building expansion was completed with the installation of the flooring, plumbing fixtures, and storage cabinets. The addition was put into service in June. Installation of the nitrogen membrane system was also completed. This system included an air compressor, membrane filter skid, and a surge tank to provide plant nitrogen. The membrane system has sufficient capacity to support all normal plant operations. The original liquid nitrogen system remains on-line in parallel, and supplants the membrane system during start-up and plant upsets. This membrane system will reduce overall plant operating costs and is expected to pay for itself within 17 months of operation. (See Figure 8: Nitrogen membrane building completed).

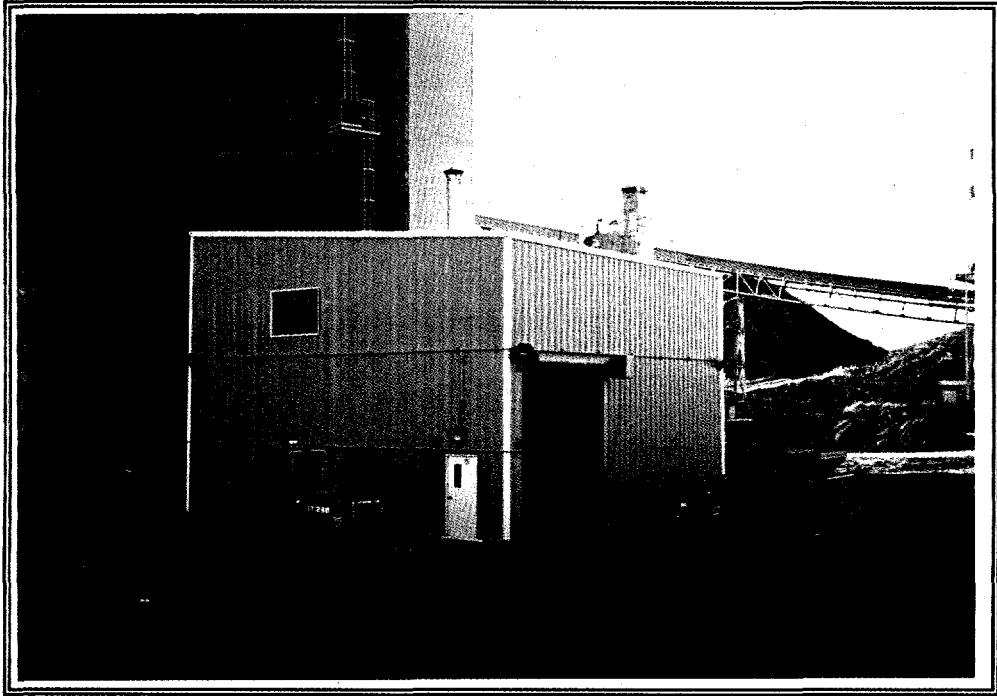


Figure 7: Process water fines handling building completed.

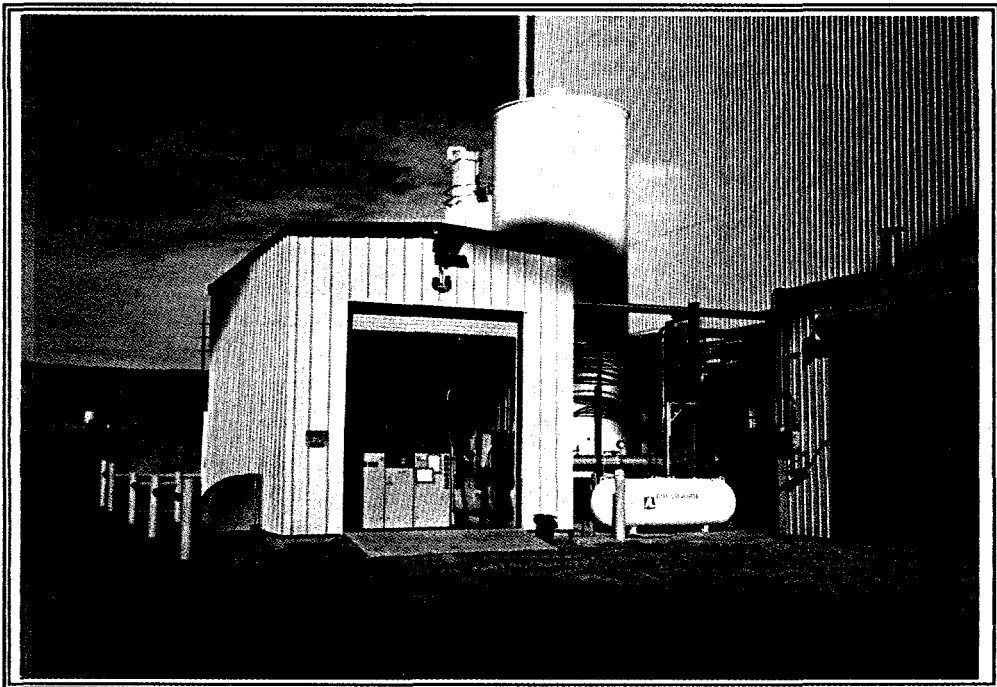


Figure 8: Nitrogen membrane building completed.

Significant visitors to the site this quarter included representatives of the following organizations or companies:

- UBE Industries
- Mitsui USA and Mitsui SPC
- ARCO, Mining Division
- Cajun Electric Cooperative and Burlington Northern
- The Wyoming Heritage Foundation
- Union Electric and Pacific Power and Light

All groups were given a presentation on the project, and a tour of the plant.

EXECUTIVE SUMMARY -- FOURTH QUARTER - *July through September 1995*

During this quarter, the main activities were plant operation, equipment maintenance, PDF stabilization testing, CDL upgrading studies, and commercial plant design and cost estimation. The plant achieved 28 days of operation and produced 6,400 tons of PDF and nearly 276,000 gallons of CDL. A train containing 6,750 tons of high sulfur PDF was shipped to Muscatine Power and Water, and six rail cars of CDL were delivered to Dakota Gas.

CDL upgrading work continued to make good progress with Dakota Gas completing a CDL characterization study. Results of this work were forwarded to Kellogg for further evaluation of upgrading processes to improve CDL marketability. Kellogg was scheduled to make process recommendations for CDL upgrading in early October.

The ENCOAL PDF stability task force continued to work on in-plant PDF stabilization methods this month. Bench scale tests for oxidizing PDF at low temperatures were run in August and September, all with promising results. Based upon the favorable bench scale tests, fabrication was begun on a larger pilot scale stabilization unit in September. This unit will test larger quantities of PDF during plant operation and is sized to produce test piles.

LFC commercial plant work proceeded well. Several options for oil recovery were evaluated and an updated heat and material balance was produced. This information was passed to MHI's engineering staff in a meeting held in Japan in late August. The meeting represented the kick-off of detailed engineering by MHI for the LFC commercial plant study.

PLANNED SCOPE OF WORK

Plant operation and maintenance were the major planned activities for the ENCOAL project this quarter. The primary objective for the 4th quarter was the continuous production of stable PDF for test burn shipments. Several PDF stabilization tests were to be completed, and ENCOAL was to make its first shipment of PDF stabilized using the VFB equipment. Commercial plant economic studies were to continue, and a CDL upgrading strategy was to be finalized. The permitting process for construction of the permanent precipitate pond was to be well underway, and an alternate coal test with North Rochelle sub-bituminous coal was to be conducted in August 1995. The annual Operations Review with the DOE was to be held in September 1995.

ACCOMPLISHMENTS

3.0 PHASE III -- OPERATION, DATA COLLECTION, AND REPORTING

3.1 Operation and Maintenance

The ENCOAL plant overcame numerous mechanical and electrical problems during the month of July and achieved start-up on July 22nd. The plant ran essentially uninterrupted until a scheduled shutdown on August 16th for one week of maintenance to prepare for AQD compliance testing. The one-week shut down was extended by 6 weeks however, due to a shortage of water on the mine site. Triton Coal's Everclear well #2 developed casing problems in late July and was taken off-line. With this well off-line, the combined use of water by the mine and the ENCOAL plant was higher than the feed into the main sedimentation pond, thereby causing the water shortage. The well was repaired in late September, and plant start-up was scheduled for mid-October pending replenishing the pond water levels. Despite the start-up problems and drought conditions, the plant achieved 28 days of operation and produced 6,440 tons of PDF and approximately 276,000 gallons of CDL.

A train containing 6,750 tons of "high" sulfur PDF was shipped to Muscatine Power and Water in Muscatine, Iowa in August. The material was scheduled for a test burn in Muscatine's unit #8 in mid-September, but proved to be too dusty to handle. The PDF was diverted to Muscatine unit #9 for combustion. The parent coal for this high sulfur PDF reacted much differently than compliance Buckskin coal. The material was difficult to handle in the ENCOAL plant and degraded rapidly during laydown pile processing. Based upon this experience, it may not be practical to process this type of PRB coal in the ENCOAL plant. PDF inventory at the end of the quarter was 0 tons. (*Table 1 summarizes significant PDF test burn shipments to date*).

TABLE 1: SIGNIFICANT PDF TEST BURN SHIPMENTS (Cumulative to date)

PDF RECIPIENT	SHIPMENT DATE	PDF (TONS)	ROM COAL (TONS)	PERCENT PDF BLEND (as Requested by Recipient)
Electric Power Development Company (EPDC)	Aug. 29, 1994	7	0	100
Western Farmers	Sept. 17, 1994	922	5,448	14.4
Western Farmers	Sept. 24, 1994	1,080	4,020	21.2
Western Farmers	Oct. 1, 1994	1,508	4,493	25.1
Western Farmers	Oct. 10, 1994	1,603	3,421	31.9
Western Farmers	Oct. 24, 1994	2,665	8,426	24.0
Muscatine Power & Water	Nov. 23, 1994	1,957	3,122	39.0
Muscatine Power & Water	Nov. 29, 1994	3,423	1,713	66.6
Muscatine Power & Water	Dec. 13, 1994	10,576	1,082	90.7
Muscatine Power & Water	Apr. 24, 1995	3,979	8,094	33.0
Omaha Public Power District (OPPD)	May 5, 1995	2,837	8,802	24.4
OPPD	May 11, 1995	2,819	8,941	24.0
OPPD	May 15, 1995	3,063	8,712	26.0
Muscatine Power & Water	Aug. 16, 1995	6,750	434	94.0
Cumulative Totals		43,189	66,708	

CDL inventory at the end of the quarter was 409,000 gallons, with an additional 128,000 gallons being shipped to Dakota Gas. CDL upgrading work proceeded on schedule. M.W. Kellogg continued work on the design and feasibility of various CDL upgrading schemes. They will make their final process recommendations and present estimated costs for CDL upgrading in a meeting scheduled for early October.

The mechanical maintenance contractor continued with plant operability improvement projects and operations assistance; namely, relocation of the CDL loadout pump, process water fines handling system piping heat tracing, and construction of a precipitate pond evaporation system.

There was one reportable and no lost time accidents on the project this quarter, and ENCOAL achieved 989 days without a lost time accident (LTA). The reportable accident occurred when process water splashed from a vessel into an operator's eyes and medication was required. A safety barbecue celebrating 900+ days without an LTA was held in August with all staff, contractor, and operating personnel attending. Contractor and operations safety meetings continued to be held to help ensure safety awareness.

3.2 Data Collection and Reporting

Monthly, Quarterly Technical Progress, and Quarterly Environmental Monitoring reports were submitted as required by the Cooperative Agreement. Plant operation and test data continues to be collected and Table 2 summarizes significant operation data for the year.

3.3 Alternate Coal Testing

Alternate coal testing was not done during this period. As shown in Phase III of the Milestone Log, an alternate coal test with North Rochelle sub-bituminous coal was scheduled for August 1995. This date has now been changed to November 1995. Truck shipments of the North Rochelle coal began arriving in late September to be stored in silos in preparation for this test. Another alternate coal test, possibly a North Dakota lignite, remains scheduled for August 1996. Other candidates such as Texas lignite and Alaskan subbituminous coal are still being considered depending on logistics and costs.

3.4 Administration

The annual operations review with the DOE was held at the site on August 16th and 17th. This included a review of environmental activities, engineering, and plant operations. A review was also held the week of August 21st in Fairview Heights, Ill., Zeigler's head office, with DOE Inspector General personnel to survey ENCOAL financial information and project performance. ENCOAL representatives also attended the 4th Annual Clean Coal Technology Conference and presented papers in the Technical and International sessions.

TABLE 2: OPERATION DATA (October 1, 1994 through September 30, 1995)

OPERATION START DATE	OPERATING HOURS	TONS OF RAW COAL FEED	BARRELS OF ACCEPTABLE CDL PRODUCED	TONS OF PDF PRODUCED	REASON FOR FINAL PLANT SHUTDOWN
Sept. 9, 1994 continued	330 (Oct. only)	6,532 (Oct. only)	2,264 (Oct. only)	2,524 (Oct. only)	VFB and Dryer grate plugging
Oct. 25, 1994	952	15,781	6,436	6,416	Pyrolyzer duct plugging
Feb. 25, 1995	1,162	22,697	11,716	10,571	Belt fire in Triton TT #2
May 31, 1995	230	6,298	3,048	1,500	Plant up and down due to numerous electrical and mechanical failures
Jul.y 22, 1995	674	14,457	6,570	6,400	Scheduled shutdown, Low water in Sed. pond #1
Cumulative totals (10/1/94 - 9/30/95)	3,348	65,765	30,037	27,411	

The ENCOAL PDF stability task force made significant progress toward producing a recommendation this quarter. The group identified key areas of concern and assembled several outside organizations to assist in the stability work. Following this agenda, a Cooperative Research and Development Agreement (CRADA) with DOE PETC/METC was completed in July. The task force also completed several bench scale tests for oxidizing PDF at low temperatures this quarter. Results were favorable and fabrication of a larger pilot scale stabilization unit was begun. This unit, when completed next quarter, will be capable of continuously handling ½ ton per hour, thus producing adequate quantities for test piles.

The test program for the COD concept was essentially completed this quarter. COD samples from the MHI test conducted in June/July were analyzed using the ROR method to determine the level of O₂ deactivation obtained in the COD unit. The results of the ROR tests indicated that the samples were not sufficiently deactivated. At least for now, further work on the COD concept is not warranted.

Several "additive" tests were also completed during the quarter. These tests investigated the addition of chemicals or coatings on plant run PDF in order to obtain a stable PDF product. Several additives were tried, but the resultant positive effects on PDF stability were poor. As with the COD concept, further work on additives is not warranted.

LFC Commercial plant work continued to make good progress. Preliminary plant layout drawings were issued and an updated process flow diagram and heat and material balance were produced. The electrical design was also initiated, and a PDF market evaluation by RDI was completed and summarized. The RDI report indicated a strong future demand for PDF at promising market prices, especially in the metallurgical industry. This work is part of the commercial plant cost and economics study begun in March 1995. The components of the study include plant design, operating costs, capital costs, cogeneration of power, CDL and PDF marketing, and overall economics of a commercial venture. The commercial plant study is expected to be complete in late 1995.

Significant visitors to the site this quarter included:

- The Department of Energy Project Manager and PETC staff (2).
- The Honorable Jim Geringer, Governor of Wyoming.
- An Australian group sponsored by the US DOE.
- A Dutch steel industry group, Hoogovens I. Jmuiden.
- Two representatives from Mitsubishi Heavy Industries, (MHI)

MHI's interest is in representing TEK-KOL in the international marketing of the LFC technology, (*besides involvement in commercial plants as a designer and equipment supplier*).

All groups were given a presentation on the project and a tour of the plant.

In addition to several modifications already approved individually, permit modifications still pending formal WDEQ approval are: (1), changes made to the waste water pond to include the installation of an access road, conduit and power, and a pumping station to return waste water to the sedimentation pond; (2), numerous proposed changes to the ENCOAL land farm to make it a permanent and easier to maintain area; and (3), determination of the size and duration of the PDF laydown area.

Work has essentially been completed on the design of the permanent precipitate disposal pond and a draft of the permit application is in final review. The construction specifications have been written and approved. Permit submittal is now planned for mid-October. Also planned for late October and November is the third party stack gas and emissions testing required to obtain ENCOAL's permit to operate from the state of Wyoming.

3.5 Equipment Modifications

The WDEQ required ENCOAL to go to public notice on the construction of the permanent precipitate pond. This requirement will delay the pond construction into 1996. An evaporation system for the temporary pond was therefore designed and installed to allow continued plant operation until completion of the permanent pond construction. The evaporation system includes a portable diesel powered pump, floating platform, and a nozzle bank to spray the effluent into the air, thereby increasing the evaporation rate. The WDEQ approved the operation of this evaporation system, and start-up was achieved in late September. (*See Figure 9: Precipitate pond evaporation system in place*).

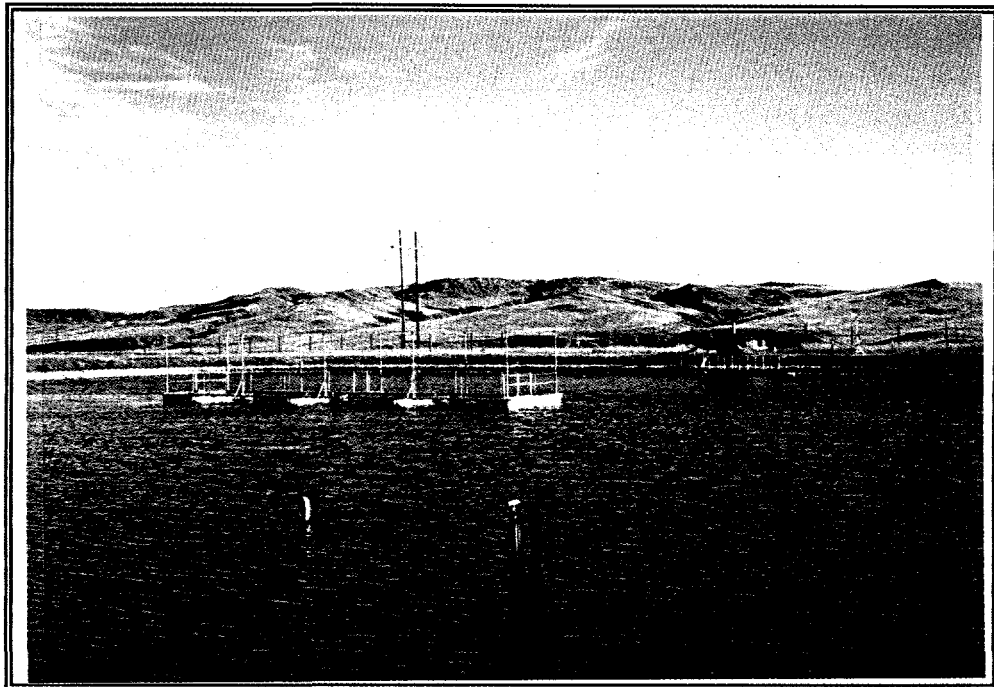


Figure 9: Precipitate pond evaporation system in place.

TECHNICAL IMPACTS ON SCHEDULE AND MILESTONES

Technical problems and plant modifications dealt with so far have affected ENCOAL's preferred schedule. Efforts to produce stable PDF with in-plant equipment have been unsuccessful, and PDF continues to be stabilized using pile layering and blending techniques. Plant modifications and installation of the VFB PDF deactivation facilities caused delays in completing several primary objectives by the end of the original Cooperative Agreement in 1994. As previously reported, ENCOAL submitted an Evaluation Report in July 1994 and requested a two year extension with an increase in the total project funding of \$9,050,000 DOE share. In October 1994, ENCOAL received approval for a two-year extension of the Cooperative Agreement in order to accomplish the remaining Project goals. Adjustments were made to the baseline schedule and costs in an update to the Project Management Plan. Revised milestones for the project are listed on the Phase III Extended Milestone Log found in Table 3.

CONCLUSIONS AND LOOK AHEAD

Several of the major objectives of the ENCOAL Project have now been achieved. The LFC Technology has been essentially demonstrated. Significant quantities of near specification CDL have been produced from Buckskin coal. Plant operation in a production mode with respectable availability (approaching 90%) has been demonstrated. Capacity has been limited to 50% of design, or 500 tons per day largely due to the limits in the VFB loop. In the next two years, increasing the throughput to near design levels is planned to uncover any other bottlenecks affecting commercial applications. Reliability of the individual pieces of equipment making up the LFC process has proved to be very good, especially the dryer, pyrolyzer, quench table, dryer blower, oil pumps and glycol pumps. (See Figure 10: ENCOAL plant looking West).

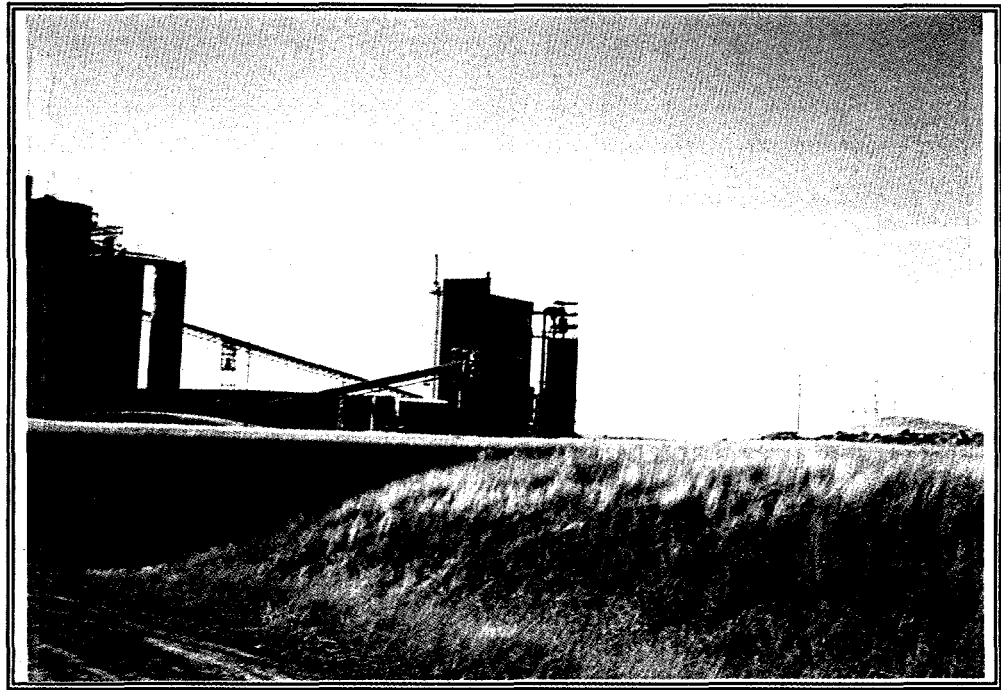


Figure 10: ENCOAL plant looking West.

PDF stabilization has been very elusive, but three methods have been successful, layered pile deactivation, blending with ROM coal, and blending with previously deactivated PDF. Expanding on this knowledge, ENCOAL plans to design and install equipment that will accomplish deactivation and rehydration, the key elements in stabilization, in the plant at near design capacity next year. Thirteen unit trains containing PDF have now been shipped and successfully test burned, and continuing shipments to additional customers is planned. Neat PDF shipments to Wisconsin Power and Light are now planned for the middle of next year. Following successful deliveries of neat and blended PDF for test burns, it is planned to perform alternate coal tests. One such test is now scheduled for November 1995, and a second one in mid 1996.

ENCOAL received approval from the DOE for a two year extension of the Project, continuing the Cooperative Agreement until September 17, 1996. The Public Design and Construction Report was completed in January. An update to the design report to include plant modifications will be done at the end of the Project. Work should continue on the replacement for the temporary precipitate storage reservoir in the next quarter, and construction is planned for early Spring 1996. Economic evaluation of a commercial plant venture should be completed in April 1996. Pending completion of the stack gas and emissions testing, a permit to operate should be obtained from the AQD. Implementation of the recommendations for in-plant stabilization and installation of facilities for CDL upgrading are planned for mid 1996. Operation of the plant in a production mode for delivery of test burn PDF and CDL should continue throughout the next year.

Table 3: ENCOAL Mild Coal Gasification Project**EXTENDED PHASE III MILESTONE LOG**

ID. No	Description	Planned Completion Date	Actual Completion Date	Comments
1	First Sale of CDL	31-Oct-92	17-Oct-92	
2	Updated Project Management Plan	31-July-94	21-July-94	
3	First Delivery of PDF	31-Aug-94	17-Sept-94	
4	Plant Performance Tests	31-July-94	15-June-94	
5	Operations Review - 50%	28-Sept-93	28-Sept-93	
6	Select Candidates for Alternate Coal Testing	31-July-94	31-July-94	
7	Technical Performance and Economic Evaluation Report	17-Sept-96		
8	Alternate Coal Testing	15-Aug-96		
9	Operations Review - 100%	17-Sept-96		
10	Complete Deactivation Modifications	1-Nov-93	12-Dec-93	
11	North Rochelle Coal Test	30-Nov-95		Revised
12	Knife River Coal Test	15-Aug-96		
13	Operations Review	15-Sept-95	17-Aug-95	
14	Wisconsin Power & Light Test Burn	27-Apr-96		Revised
15	Complete Dryer Water Seal Installation	31-Jan-95	6-Feb-95	
16	Plant Modifications	31-July-96		Revised

GLOSSARY

AQD	Air Quality Division of the Wyoming Department of Environmental Quality
AquaTerra	AquaTerra Consultants in Sheridan, Wyoming
CDL	Coal Derived Liquid
Center	SGI Development Center in Perrysburg, Ohio (<i>LFC pilot plant and lab</i>)
COD	Cascade Oxidative Deactivation Unit
CRADA	Cooperative Research and Development Agreement
DOE	U.S. Department of Energy
EMP	Environmental Monitoring Plan
EMS	Equipment Management System
ENCOAL	ENCOAL Corporation, a wholly-owned subsidiary of SMC Mining Company
EPA	U.S. Environmental Protection Agency
EPC	Engineering, Procurement, and Construction
ESP	Electrostatic Precipitator
FGD	Flue Gas Desulfurization
HVAC	Heating, Ventilation and Air Conditioning
Kellogg	The M.W. Kellogg Company
LFC	Liquids From Coal
LTA	Lost Time Accident
METC	Morgantown Energy Technology Center, United States DOE
MCC	Motor Control Center
MHI	Mitsubishi Heavy Industries in Hiroshima and Tokyo, Japan
MR&E	Maumee Research and Engineering in Perrysburg, Ohio
MSHA	Mine Safety and Health Administration
Muscatine	Muscatine Power and Water in Muscatine, Iowa
NEPA	National Environmental Policy Act
OPPD	Omaha Public Power District in Omaha, Nebraska
PDF	Process Derived Fuel
PETC	Pittsburgh Energy Technology Center, United States DOE
PLC	Programmable Logic Controller
PMP	Project Management Plan
PRB	Powder River Basin
P&ID	Piping and Instrumentation Diagram
QA/QC	Quality Assurance / Quality Control
R ₂ D ₂	Quench Table Steam Condenser Heat Exchanger
RDI	Resource Data International in Boulder, Colorado
ROM	Run-of-Mine coal
ROP	Run-of-Plant PDF
ROR	Residual Oxidation Rate
S-belt	Flexible wall vertical bucket type conveyor
SGI	SGI International, LaJolla, CA
SMC	SMC Mining Company, a wholly-owned subsidiary of Zeigler Coal Holding Co.
Syncoal	Western Syncoal Inc. in Billings, Montana
TSP	TSP Incorporated in Sheridan, Wyoming (<i>Engineering Consulting firm</i>)
VFB	Vibrating Fluidized Bed
WDEQ	Wyoming Department of Environmental Quality
WFEC	Western Farmers Electric Cooperative in Hugo, Oklahoma
ZCHC	Zeigler Coal Holding Company