SCALE-UP OF MILD GASIFICATION TO A PROCESS DEVELOPMENT UNIT

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By

Elliott P. Doane
R. H. Carty
H. Foster

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U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

By

Kerr McGee Coal Corporation
123 Robert S. Kerr Avenue
Oklahoma City, Oklahoma 73102

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SUMMARY

The work performed during the twelfth quarterly reporting period (August 21 through November 20, 1994) on the research program, "Scale-Up of Mild Gasification to a Process Development Unit" is presented in this report. The overall objective of this project is to develop the IGT Mild-Gasification (MILDGAS) process for near-term commercialization. The specific objectives of the program are to:

- design, construct, and operate a 24-tons/day adiabatic process development unit (PDU) to obtain process performance data suitable for further design scaleup
- obtain large batches of coal-derived co-products for industrial evaluation
- prepare a detailed design of a demonstration unit
- develop technical and economic plans for commercialization of the MILDGAS process.

The project team that is performing the initial phases of the PDU development are: Kerr-McGee Coal Corporation (K-M Coal), the Institute of Gas Technology (IGT), Bechtel Corporation (Bechtel), and Southern Illinois University at Carbondale (SIUC).

The MILDGAS process is a continuous closed system for producing liquid and solid (char) co-products at mild operating conditions up to 50 psig and 1300°F. It is capable of processing a wide range of both eastern caking and western noncaking coals.

The 1 ton/hr PDU facility that is to be constructed is comprised of a 2.5-ft ID adiabatic gasifier for the production of gases, coal liquids, and char; a three-stage condensation train to condense and store the liquid products; and coal feeding and char handling equipment. The facility will also incorporate support equipment for environmentally acceptable disposal of process waste.

This quarter, the phase one civil contract was awarded to J & L Robinson of Carbondale, IL. The subcontractor and Bechtel Construction Management were mobilized in the middle of September and the contract completed in early November. This work included clearing, grubbing, grading and backfilling of the site, installation of culverts and fencing, placing of the main structure foundation and truck pad, and installation of gravel on the areas that will later be blacktopped.

Negotiations with Kilborn Engineering were halted due to disagreements on the terms and conditions of the contract, and Bechtel completed an analysis of alternatives to Kilborn. Included were: Bantrel Inc. located in Calgary, Alberta, Canada; the Indian office of Bechtel; and Roberts and Schaefer Engineering of Salt Lake City, Utah. The Indian office of Bechtel is a new group with relatively little experience, and this option was excluded because of the possible negative impact on both schedule and final costs. Roberts and Schaefer was selected as the most cost effective firm, and a contract was negotiated with them.

Also this quarter, a contract for the emissions control package was awarded to Calidus Technologies. In addition, agreement with Central Illinois Power Service on the electrical supply scope and the natural gas delivery pressure was made and the FAA waived any requirement for aircraft warning devices on the top of the structure.

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INTRODUCTION

Commercialization of the Institute of Gas Technology's Mild Gasification (MILDGAS) technology introduces a new industry into an economically depressed area. It utilizes a marginally marketable coal to produce char, in an environmentally acceptable manner, that can be used to make form coke, which is vitally needed in our metallurgical industry. It produces coal liquids which address import problems, and it also addresses the use of char for our electric utility industry. The specific objectives of the program are to: design, construct, and operate a 24-tons/day adiabatic process development unit (PDU) to obtain process performance data suitable for further design scaleup; obtain large batches of coal-derived co-products for industrial evaluation; prepare a detailed design of a demonstration unit; and develop technical and economic plans for commercialization of the MILDGAS process.

The MILDGAS process is capable of processing both eastern caking and western non-caking coals. The MILDGAS process is designed to offer options in the product slate by varying the process conditions and by blending different feed coals. The liquids, which can be processed as feedstocks for chemicals (e.g., BTX, phenol, cresols, xylenols, naphthalene, and indene), pitch for use as a binder for electrodes in the aluminum industry, and fuels. Depending on the feed coal characteristics and the operating conditions, the char can be used as an improved fuel for power generation or briquetted hot to make form coke for steel-making blast furnaces or for foundry cupola operations. The hot briquetting process offers options for blending various chars, coals and other additives (like alloying agents) to tailor the properties of the form coke. The mild gasification and briquetting processes are done entirely within closed vessels which offer significant advantages over conventional coking practices for control of fugitive emissions.

The 1 ton/hr PDU facility that is to be constructed is comprised of a 2.5-ft ID adiabatic gasifier for the production of gases, coal liquids, and char; a three-stage condensation train to condense and store the liquid products; and coal feeding and char handling equipment. The facility will also incorporate support equipment for environmentally acceptable disposal of process waste.

Coal liquids from the PDU will be evaluated as feedstock for high-value chemicals and fuels by Reilly Industries, Inc. Reilly will also conduct separate modification operations such as thermal treatment with or without a Lewis Acid Catalyst, fractional distillation, and hydrotreating to produce specification-grade products. Reilly will take all the coal liquids produced at the PDU facility.

A major portion of the char produced will be used to make the form coke for blast furnaces and cupolas. The form coke for blast furnaces will be evaluated by several steel companies, including

LTV and Armco. The form coke for use in a foundry cupola will be evaluated by General Motors Research Laboratories. In addition, the form coke will also be tested for foundry use at Pellet Technology Corporation's 60-inch cupola. The char from the PDU will also be evaluated at Southern Illinois University at Carbondale (SIUC) for relative reactivity and for suitability as a boiler fuel in a fluidized-bed combustor.

The product testing to be conducted in the program will yield a realistic assessment of the quality and economic value of both the coal liquids and solids produced. This input is required to update the market potential of the co-products and determine the slate of products and the economics of the demonstration and commercial plants for the MILDGAS process. The project team for the PDU development are: K-M Coal, Institute of Gas Technology (IGT), Bechtel Corporation, SIUC, General Motors Corporation, Pellet Technology Corporation (PTC), LTV, Armco, Reilly and Auto Research.

K-M Coal, which has large reserves of both eastern and western coals, is very much interested in near-term commercialization of the MILDGAS process. K-M Coal is responsible for the overall management and technical direction of the program. IGT, as the originator of the MILDGAS technology, is responsible for technology development, product evaluation management, and overall technical supervision. Bechtel Corporation is the A&E firm responsible for the process and plant design and construction, development of a demonstration plant design, and input to the commercialization plan revision. SIUC operates the Illinois Coal Development Park at Carterville, Illinois, which will be the location of the PDU. SIUC is responsible for operation of the PDU facility and for evaluation of the char product as a boiler fuel.

The State of Illinois is the major contributor of the cost sharing portion of this program. Their contribution is being supplemented by K-M Coal, SIUC, and GM. Contributions of Reilly and the steel companies are gratefully acknowledged but are not considered part of the cost sharing. All acceptable grades of form coke produced will be sold by Hickman Williams Co., the largest brokers for coke in the midwest.

TECHNICAL DISCUSSION

Task 1.0 Work and Environmental Plans

Objective: The objective of this task is to develop work and environmental plans for the project.

Summary: The Environmental Plan and NEPA Documentation consist of the data that are required by DOE for compliance with the National Environmental Policy Act (NEPA). All of the work on this task was completed and the NEPA document submitted in April 1993.

The Environmental Assessment (EA) was prepared by DOE and submitted in September, 1993 to the State of Illinois and the Crab Orchard Wildlife Refuge for comments. Neither organization found any issue with the EA that would prevent construction of the PDU at the proposed site. They did submit comments which were taken into consideration in revising the EA.

The Finding of No Significant Impact (FONSI) for this project was received on February 10, 1994. This task is now complete.

Subtask 2.1 Design Engineering

Objective The objective of this task is to complete the detailed design and engineering for the PDU. This includes the process design, the civil/structural design, the electrical and controls design, the mechanical design, procurement, and definitive cost estimate.

Summary This quarter, negotiations with Kilborn Engineering were halted due to disagreements on the terms and conditions of the contract. Bechtel prepared an analysis of alternative engineering firms including: Bantrel Inc. located in Calgary, Alberta, Canada; the Indian office of Bechtel; and Roberts and Schaefer Engineering of Salt Lake City, Utah. The Indian office of Bechtel is a new group with little experience, and this option was excluded because of the possible negative impact on both schedule and final costs. The comparison of these options led to choosing Roberts and Schaefer as being the best choice based on cost and experience. A contract is in place with Roberts and Schaefer, and work on the detailed engineering has begun.

Also this quarter:

- a contract for the emissions control package was awarded to Calidus Technologies
- agreement with Central Illinois Power Service on the electrical supply scope and the natural gas delivery pressure was made
- the FAA waived requirement for aircraft warning devices on the top of the structure
- a fire protection assessment has been made by Bechtel and submitted to the Carbondale fire department for approval.

Plans for Next Quarter In the next quarter, the detailed engineering will be started and the contract for the char handling package will be awarded.

Task 2.2 PDU Construction and Shakedown

Objective Now that the FONSI has been received, this task is being reactivated. In this task, the permit to construct will be obtained and the PDU designed in Task 2.1 will be constructed and shaken down.

Summary This quarter, work at the job site commenced with the award of the phase one civil contract to J & L Robinson of Carbondale, IL. Mobilization of the subcontractor and Bechtel Construction Management began in the middle of September, and this site work was completed in early November. The work included:

- Clearing and grubbing of the site
- Grading and back filling of the area
- Installation of culverts
- Erection of security fencing
- Placing of the main structure foundation and truck pad
- Laydown of gravel on the areas that will later be blacktopped

Plans for Next Quarter In the next quarter, plans will be started for erecting the structural steel.

Tasks 2.3 through Task 6.

No work was scheduled on these tasks for this quarter.

Task 7.0 Project Management

Objective The objectives of this task include the normal project management functions of planning, control, and reporting of project progress.

Summary This quarter, project management consisted of preparation and submittal of the monthly and quarterly reports and conferring with DOE and the other team members on the status of the project.

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