DOE/PC/94114--T4

INSTALLATION OF A STOKER-COAL PREPARATION PLANT

IN

KRAKOW, POLAND

Technical Progress Report 4

January - March, 1995

Work Performed Under Cooperative Agreement DE-FC22-94PC94114

EFH Coal Company

Wilkes-Barre, PA

TECHNICAL PROGRESS REPORT 4

January - March, 1995

INSTALLATION OF A STOKER-COAL PREPARATION PLANT IN KRAKOW, POLAND

By
Pete Rozelle, Program Manager
EFH Coal Company

Cooperative Agreement No.
DE-FC22-94PC94114

Project Officer
Thomas J. Feeley, III
U.S. Department of Energy
Pittsburgh Energy Technology Center
P.O. Box 10940
Pittsburgh, PA 15236

TABLE OF CONTENTS

LIST OF TABLES & FIGURES

LIST OF TABLES

LIST OF FIGURES

INSTALLATION OF A STOKER COAL PREPARATION PLANT IN KRAKOW, POLAND

EXECUTIVE SUMMARY

This report describes the progress made during this reporting period of a two year project to demonstrate that the air pollution from a traveling-grate stoker being used to heat water at a central heating plant in Krakow, Poland can be reduced significantly by (1) substituting the unwashed, unsized coal currently being used with a mechanically cleaned, double-sized stoker fuel and by (2) optimizing the operating parameters of the stoker. It is anticipated that these improvements will prove to be cost-effective and hence will be adopted by the other central heating plants in Krakow and ideally, throughout Eastern European cities where coal continues to be the primary source of fuel.

EFH Coal Company has formed a partnership with two Polish institutions -- MPEC, a central heating company in Krakow, and Naftokrak-Naftobudowa, preparation plant designers and fabricators--for the execution of this effort.

Five potential candidate sources have been located and contracts for coal deliveries should be executed early next quarter. Those contracts will be performance based in that remuneration will be based on the actual yield of stoker-quality coal produced by the new plant.

Initial delays in formalizing the EFH/Polish Partners agreement delayed finalizing the coal supply contracts and hence, precluded collecting the Polish coal samples for characterization and combustion performance studies (Task 1.0). Work on this Task will be initialed next quarter after the raw coal supply contracts are executed.

Additional meetings were held with Polish coal preparation equipment suppliers to obtain availability, price, and delivery quotations for long lead-time process equipment. This activity is complete.

A conceptual design for a plant to wash 25 mm x 0 raw coal fines at a feed rate of 300 mtph was completed. This plant will receive raw coals ranging in ash content from 20 to 30 percent and produce a compliance coal containing about 1 percent ash, 0.8 percent sulfur and 27,840 KJ/kg (12,000 Btu/lb). A heavy-media cyclone will be used to wash the 20 mm x 1 mm stoker coal.

Discussions with financial institutions regarding the cost of producing a quality stoker coal in Poland and for identifying sources of private capital to help cost share the project continued.

The search for markets for utilizing surplus production from the new plant continues.

Because of the unanticipated delays encountered during the onset of the project, with forming the EFH Coal/Polish partnership and in negotiating long-term raw coal supply contracts, a 90-day, no-cost extension was requested and was granted.

INTRODUCTION

The work being performed under this Cooperative Agreement between the United States Department of Energy (DOE) and EFH Coal Company (Participant) is one part of the assessment program in the Support for Eastern European Democracy (SEED) Act of 1989 (P.L. 101-179).

In October 1991, a Memorandum of Understanding (MOU) titled "Collaboration on the Krakow Clean Fossil Fuels and Energy Efficiency Program, A Project of Elimination of Low Emission Sources in Krakow" was signed by the DOE and the Ministry of Environmental Protection, Natural Resources and Forestry of the Republic of Poland, that describes the cooperation that is being undertaken by the respective governments to accomplish the goals of this program.

The DOE has selected eight U.S. companies to work with the government of Poland to improve the country's air quality, particularly around the historic city of Krakow. Although the program is focused on Krakow, it is intended to serve as a model for similar pollution control programs throughout Poland and, hopefully, much of Eastern Europe. The total cost of the SEED program is $31 million with the DOE funding about half that amount.

It is estimated that currently there are 23 district heating plants, 3,000 small boilers, and 125,000 home stoves in use in the Krakow area-- all coal fired.

PURPOSE

The purpose of the U.S./Polish Memorandum of Understanding is to encourage the formation of commercial ventures by providing project development support, resources, and services to reduce low-emission sources in Krakow, Poland.

These commercial ventures can take the form of contracts, joint ventures, partnerships, and other commercially-feasible arrangements to achieve the purposes of this statute.

OBJECTIVE

The specific objective of the work to be performed by EFH Coal under the terms of this Cooperative Agreement is to improve the quality of stack gas emissions from low-stack boilers in the Krakow area of Poland.

This objective will be accomplished by designing, constructing, and operating a beneficiation facility that will produce a low-ash, double-sized stoker coal for burning in a typical traveling-grate stoker commonly in use throughout this area. The low-ash, uniformly sized, quality stoker coal when burned properly in existing boilers will increase combustion efficiency, reduce stoker maintenance, and reduce significantly carbon monoxide, sulfur dioxide, and particulate levels in the stack gas emissions.

To facilitate the achievement of the stated objective, EFH Coal has executed an agreement with MPEC (a district heating company in Krakow) and Naftokrak/Naftobudowa (a construction and maintenance enterprise) to design, construct and operate a 300 mtph coal cleaning facility. EFH Coal has also subcontracted with the Pennsylvania State University to characterize two candidate Polish coals and to perform combustion tests on washed sublots of these Polish coals in their combustion simulator facility.

WORK STATEMENT

It is projected that a two-year effort will be needed to accomplish the objectives of this Cooperative Agreement, consisting of two budget periods and including the following nine tasks:

Budget Period I

- Task 1 - Polish Coal Washability and Combustion Performance Evaluation
- Task 2 - Raw Coal Supply Contracts
- Task 3 - Specification of Major Preparation Plant Components
- Task 4 - Preparation Plant Flowsheet Design
- Task 5 - Cost Evaluations
- Task 6 - Securing Stoker Coal Supply Contracts
- Task 7- Final Economic Evaluation and Risk Assessment

Budget Period II

- Task 8 - Plant Construction
- Task 9 - Plant Startup and Demonstration

PROGRESS DURING THE PERIOD

Task 1.0 - Polish Coal Washability and Combustion Performance

Subtask 1.1 - Washability Characterization

No Activity

Subtask 1.2 - Stoker Combustion Performance Evaluation

No Activity

Subtask 1.3 - Training Program

No Activity

Task 2.0 - Raw Coal Supply Contracts

Negotiations continued throughout the reporting period with seven holding companies. As shown in Table 1, these seven holding companies operate 60 coal mines throughout the Silesean area of Poland with an annual production rate of more than 35 million metric tons. To date, draft contracts have been negotiated with the Gilwicka, Katowice, and Nadwislowska holding companies operating a total of 26 mines with an annual production in excess of 28 million metric tons.

Based on data evaluated to date, it is clear that supplies of raw coal adequate to meet the raw coal requirements of this project terms of quantity, quality, and price are readily available.

Task 3.0 - Specification of Major Preparation Plant Components

This task is completed.

All of the major preparation plant components have been identified and sized. Sources, prices, and delivery dates currently are being sought for all of these major components. Based on quality, availability, and price, it is anticipated that most of the major components (e.g., washing units, vibrating screens, and magnetic separators) will be purchased in the United States, while most of the ancillary equipment (e.g., motors, conveyors, and pumps) will be purchased in Poland.

One of the options being considered is to have the plant fabricated in the U.S. as a modular plant and ship the modules to Poland where they will be assembled on site.

TABLE 1 - LIST OF POTENTIAL COAL SUPPLIERS VISITED

Holding Company	Number of Mines	Raw Fines Production Million mtpy	Status
Bytom	12	3.1	Ongoing Discussions
Gliwicka	7	11.4	Draft Contract
Jastrzenbie	7	--	--
Katowice	11	9.7	Draft Contract
Nadwislowska	8	7.2	Draft Contract
Rudzka	8	--	--
Kybnicka	7	3.9	Ongoing Discussions

Task 4.0 - Preparation Plant Flowsheet Design

This task is completed

The plant as currently conceived is designed to wash 25 mm by 0 raw coal fines containing from about 20 to 30 percent ash at a feed rate of 300 mtph and produce a "compliance" coal containing about 10 percent ash, 0.8 percent sulfur, and 27,840 KJ/kg (12,000 btu/lb).

Figure 1 is a schematic of the conceptual flowsheet for the proposed stoker-coal plant.

Raw coal fines have a nominal top size of 25 mm are fed onto a belt conveyor by means of a feeder at a dry feed rate of 300 mtph. After passing over a permanent magnet to remove any tramp iron that might be present in the coal, the raw coal flows into a prewet box where it is mixed with water and then fed to a double-deck primary vibrating sizing screen fitted with a 25-mm woven-wire screen on the top deck and an 8-mm woven-wire screen on the bottom deck; this vibrating screen is equipped with additional water sprays to provide a sharper size separation.

The 25 mm oversize product from the primary sizing screen is rejected as waste; the 25 mm by the 8 mm product off the lower screen deck is rescreened on a single-deck secondary vibrating screen dressed with 1 mm wedge-wire screen.

The underflow from the primary sizing screen containing the minus 8 mm raw coal passes over a sieve bend dressed with 2 mm wedge-wire screen where a 1 mm size separation is made. The minus 1 mm sieve bend underflow (with the bulk of the water) is combined with the underflow from the secondary sizing screen to form the feed to a fine coal cleaning circuit consisting of either a hydrosizer or column flotation.

The 8 mm by 1 mm sieve bend oversize and the 25 mm by 8 mm oversize from the second deck of the primary sizing screen are combined to form the feed to the coarse-coal plant where it is fed to a dense media sump, mixed with water and magnetite media, and pumped to a dense-medium cyclone.

The clean coal product (overflow) from the cyclone along with the bulk of the media is fed onto a clean coal vibrating drain-and-rinse screen where, on the first portion of the screen, the media is recovered from the product and returned to the circuit; water sprays on the second portion of the screen rinse the remaining medium from the product with the diluted medium recovered separately and sent to a clean-coal magnetic separator; the nonmagnetic particles from the magnetic separator are sent to the fine-coal circuit and the magnetite is returned to the heavy-media circuit.

The dewatered clean-coal product drops onto a tertiary sizing screen dressed with a 6-mm screen where the undersize is removed to make a 20-mm. by 6-mm. stoker-size washed product and a minus 6 mm washed utility coal. If desired, this screen can be bypassed to produce a 25 mm by 1 mm washed utility coal. These products are sent to their respective belt conveyors for stockpiling.

The cyclone refuse product (underflow) from the cyclone is similarly treated on a separate drain-and-rinse screen except that the nonmagnetics from the refuse magnetic separator are discarded as waste. The dewatered refuse drops onto a refuse belt conveyor that feeds the refuse stockpile.

The washed stoker coal will be burned in the traveling grate stokers in the MPEC district heating boilers; the excess washed utility coal will be sold to the domestic utilities and/or exported.

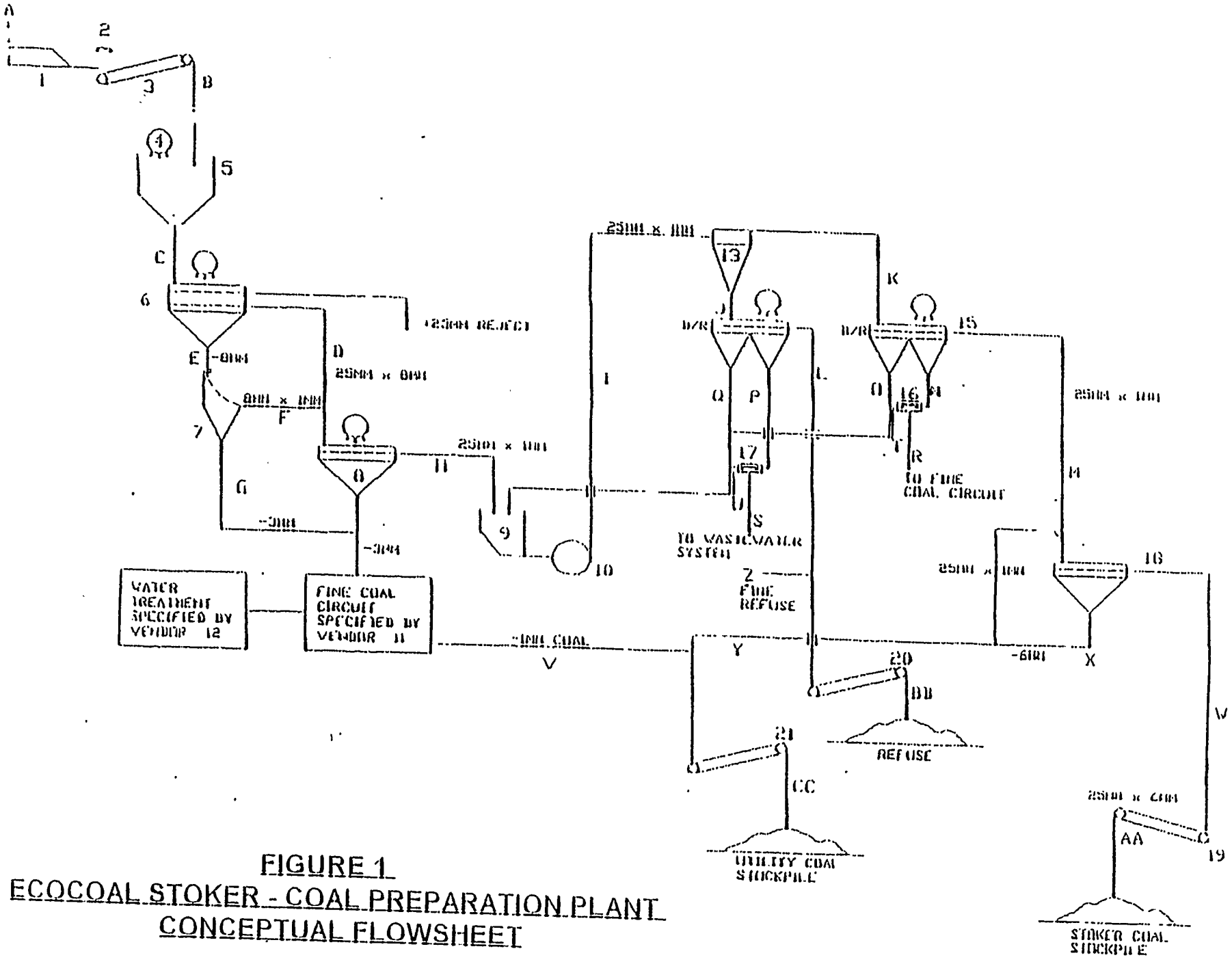


FIGURE 1
ECOCOAL STOKER - COAL PREPARATION PLANT
CONCEPTUAL FLOWSHEET

Task 5.0 - Cost Evaluations

Work is progressing on determining the production costs of the prepared stoker coal. These preliminary costs are based on the following assumptions:

- The raw coal supply will be located 30 km from the plant site and will have an estimated rail hauling cost of $1/ton
- The connected electrical load to the plant will be 350 kw and cost $0.0577/kwh
- It will require a six-person crew to operate the plant for a total hourly labor cost of $33
- Two front-end-loaders will be needed at a total cost of $90/hr
- The raw coal feed to the plant will cost $35/ton dry or $32/ton @ 8 percent moisture
- The plant will operate two eight-hour shifts per day, six days per week for a utilization of 57 percent
- The plant will have an availability of 80 percent
- Refuse disposal will cost $0.50/ton
- The plant operating cost will be $150/hr
- The plant will require about 1.2 mtpy of raw coal feed

Following is a listing of some of the major activities that are currently being undertaken at the recently-leased plant site in the abandoned Copalnia Dolomitu mine near the town of Jaworzno:

- Obtain local, state, and federal permits for; surface facilities; water usage; and refuse disposal
- Survey the refuse disposal areas at the site to determine the acreage and average depth of the worked-out areas; compile information on the stratigraphy and quality of reserves; locate groundwater table and determine the water quality; and determine if the pit will require lining
- Select stockpile areas of sufficient size to hold surplus coals and determine stormwater runoff requirements
- Determine ground- and surface-water qualities and water-quality standards for preparation plant discharges
- Prepare an environmental assessment statement

Following are some of the data that are being compiled relative to determining the final cost of the washed stoker coal:

- Firm quotes for electrical power at the site
- Firm quote for process water (if required)
- Commercial rates for leasing/renting: refuse haul trucks; dozers; front-end-loaders; road maintenance equipment; and a water truck
- Availability and cost of plant and mobile equipment maintenance
- Legal fees
- Environmental permit costs
- Availability of supervisory and general labor
- Insurance requirements
- Debt service costs

Task 6.0 - Securing Stoker Coal Supply Contracts

Negotiations with a number of potential buyers of any washed stoker coals and utility coals that are in excess of the needs of the demonstration stoker-fired boiler plant continued throughout the reporting period.

Task 7.0 - Final Economic Evaluation and Risk Assessment

Progress continued on this task during the reporting period. However this task cannot be completed until: the sources of raw coal are identified; their washability characteristics determined and combustion performance parameters proven; the preparation plant design finalized; the capital, operating, and maintenance costs are developed; and the ultimate cost of meeting all of the environmental requirements are evaluated.

DIFFICULTIES ENCOUNTERED

The continuing delays in negotiating raw coal purchase agreements with the owner of the Polish holding companies had the "domino effect" of delaying the collection of coal samples for washability testing, combustion performance testing, and operator training (Subtasks 1.1, 1.2, and 1.3).

FUTURE WORK

- Execute long-term raw coal supply contracts with at least two Polish coal-holding companies (Task 2.0).
- Initiate work on Subtasks 1.1 (coal washability), 1.2 (combustion performance), and 1.3 (training), as quickly as coal samples become available.
- Finalize the conceptual plant flowsheet (Task 4.0).
- Execute surplus coal sales contracts (Task 6.0).
- Continue to develop the economic evaluation and risk assessment (Task 7.0).

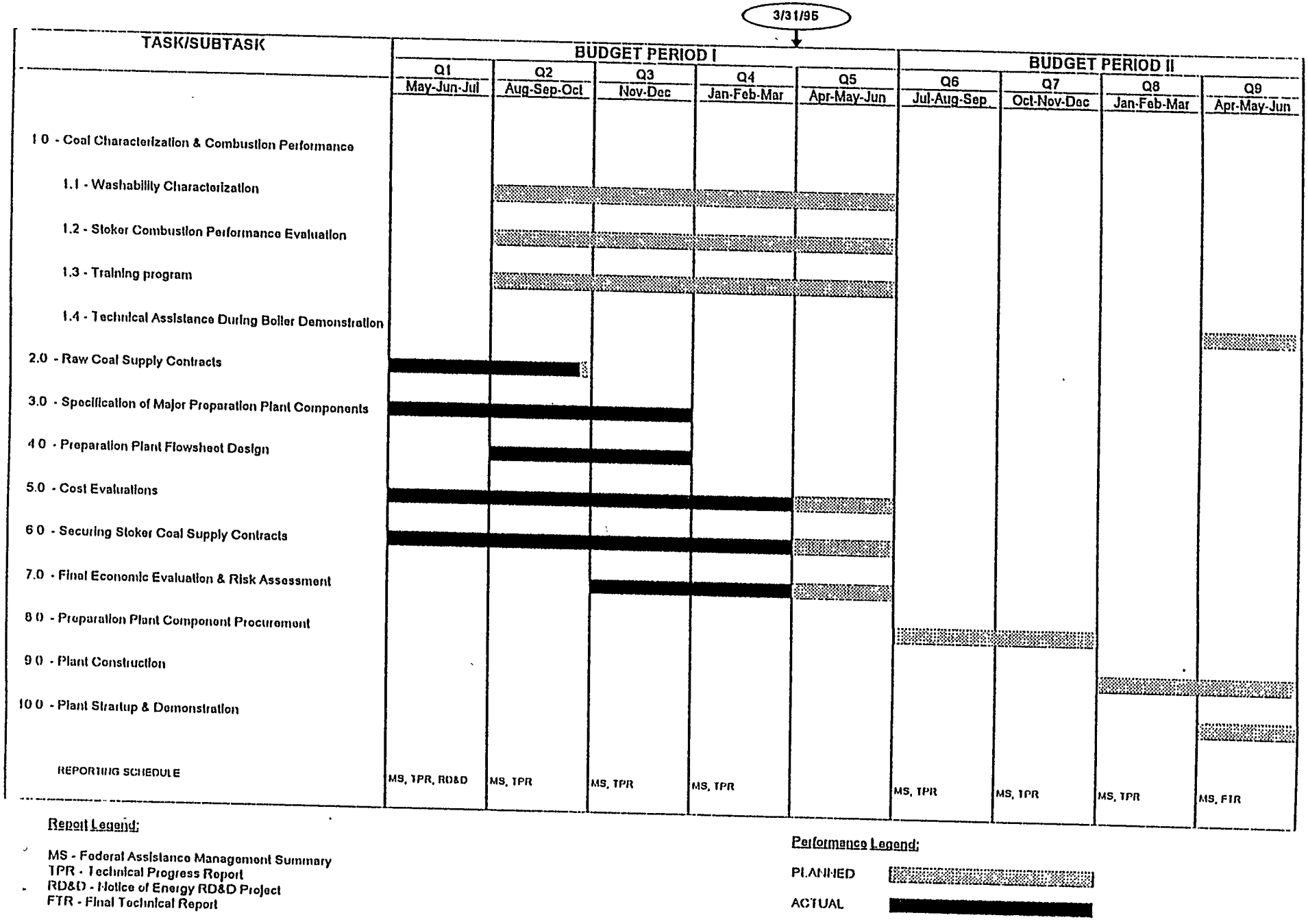
Because of the inordinately long time it is taking to negotiate long-term raw coal supply contracts with Polish coal suppliers, a 90-day no-cost-extension was requested for Budget Period I from the Department of Energy and was granted.

The revised Gantt Chart shown in Figure 2 summarizes progress to date.

Figure 2 - GANTT CHART (REVISED)

KRAKOW CLEAN FOSSIL FUELS AND ENERGY EFFICIENCY PROGRAM

INSTALLATION OF A STOKER COAL PREPARATION PLANT IN KRAKOW, POLAND



Report Legend:

MS - Federal Assistance Management Summary
TPR - Technical Progress Report
RD&D - Notice of Energy RD&D Project
FTR - Final Technical Report

Performance Legend:

PLANNED

ACTUAL