

DOE/PC/94114--T8

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

Technical Progress Report 9

April - June, 1996

Work Performed Under Cooperative Agreement DE-FC22-94PC94114

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TECHNICAL PROGRESS REPORT 9

April - June, 1996

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

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Cooperative Agreement No.  
DE-FC22-94PC94114

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

**EXECUTIVE SUMMARY**

This report describes the progress made during this reporting period of a project to demonstrate that the air pollution from a traveling-grate stoker being used to heat water at one of MPEC's central heating plants in Krakow, Poland can be reduced significantly by (1) substituting the unwashed, unsized coal currently being burned 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.

The long-term supply of 750,000 tons per year of raw coal feed to the proposed 300 tph stoker coal plant is now guaranteed by the Katowice Coal Holding Company.

The long-term lease of a site to erect the proposed plant has been executed. This site, near the Kazimierz-Julius mine has all of the infrastructure needed to operate the plant efficiently and economically.

All of the permits required by the Municipality of Sosnowiec and the Voivodeship of Katowice are now in place.

Quotations for a 300 tph modular heavy-medium cyclone plant have been received and are being evaluated.

Arrangements for disposing of up to 3 million cubic yards of refuse from the proposed plant are completed.

A sixth 90-day no-cost extension was requested of DOE and was approved.

Following last Quarter's decision by the Bilateral Steering Committee, permission was granted (May 1996) by the DOE to proceed to Budget Period II.

## **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.

The results of an air-quality study in the Krakow area during the 1984-1986 period indicated that the source of approximately 40 percent of the low level air pollutants (especially solid particulates) were attributable to an estimated 1,600 boiler houses and 200,000 tile space heating stoves--all coal-fired. A complete inventory of low level emission sources conducted during the period 1989-1990 found 1,300 boiler houses and about 130,000 tile stoves in operation (Wertz, 1995). A more detailed inventory (Cyklis, 1995) showed that about 200 mechanical stokers and 2,000 fixed-grate stokers are currently in operation in the Krakow area.

## **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 the Krakow area of Poland.

These commercial ventures take the form of contracts, joint ventures, partnerships, and other commercially-feasible arrangements to achieve the intended 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 through the use of double-screened, washed stoker coals.

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 used commonly throughout the Krakow area. The low-ash, uniformly sized, stoker coal, when burned properly in existing boilers, will increase combustion efficiency, reduce stoker maintenance, and reduce significantly the 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 Municipal Heat Distribution Enterprise (MPEC), a district heating company in Krakow and Naftokrak/Naftobudowa, a construction and maintenance enterprise, to design, construct and operate a 300 tph 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 Penn State's combustion simulator facility.

## **WORK STATEMENT**

It was projected that a two-year effort would 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 THIS PERIOD**

### **Task 1.0 - Polish Coal Washability and Combustion Performance**

#### **Subtask 1.1 - Washability Characteristics**

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**

This task is completed.

### **Task 3.0 - Specification of Major Preparation Plant Components**

This task is completed.

### **Task 4.0 - Preparation Plant Flowsheet Design**

This task is completed.

### **Task 5.0 - Cost Evaluations**

This task is completed.

### **Task 6.0 - Securing Stoker Coal Supply Contracts**

Negotiations continued with a number of additional potential customers for any stoker coal that might be produced in excess of that of MPEC's needs.

## Task 7.0 - Final Economic Evaluation and Risk Analysis

The evaluation of proposals from U.S. manufacturers of modular preparation plants that can be fabricated in the U.S. and shipped to the Kazimierz-Julius site continued. The advantages of a modular pre-engineered plant over a customized conventional plant is based on the following facts:

- The time to complete a modular plant for a 300 tph dense medium plant is about half that of a conventional plant;
- The cost of a modular plant is estimated at 10 to 15 percent less than that of a conventional plant;
- The modules are sized approximately 12 ft. by 12 ft. by 30 to 40 ft. long for easy transport by rail, truck or container ship;
- Field work is virtually eliminated as essentially all of the electrical, piping, structural, and plate work is done in an assembly shop under ideal conditions;
- Foundation requirements (either piles or a slab) are minimal as each module is constructed with a number of columns for structural integrity; and
- Field erection is simple, requiring little more than a crane to hoist the modules in place, bolt them together and make the pre-engineered connections.

There are a number of modular plant builders in the U.S. One manufacturer (Birtley, 1996) provides a range of plant capacities (Table 1) which use heavy medium cyclones as the primary washer.

**TABLE 1 - Modular Plant Parameters**

Dry Feed Rate, tph.	Max. Feed Size, ins.	Power Req., hp..	Makeup Water Req., gpm
55	0.75	125	45
165	1.75	355	110
220	2.00	550	135

Based on the assumptions that:

- the feed rate to the cyclone circuit will be 300 dtph;
- the feed size will be 20 mm by 0.5 mm;
- the medium to coal ratio will be 4:1;
- the mean specific gravity of the feed will be 1.3; and
- the specific gravity of the medium will be 1.5

The two potential cyclone sizes (Krebs, 1996) are as shown in Table 2.

**TABLE 2 - Heavy Medium Cyclone Parameters**

Cyclone Diameter, ins.	Feed Rate, gpm			Feed Rate, dtph.
	Coal	Media	Total	
24	240	960	1,200	78
26	480	1,920	2,400	156

Therefore, either four 24-in.-diameter or two 26-in.-diameter heavy medium cyclones would be adequate for washing the 20 mm. by 0.5 mm. raw coal at the feed rate of 300 dtph.

## **DIFFICULTIES ENCOUNTERED**

The extended delay in negotiating raw coal supply contracts has precluded the washability testing of the raw coal and the simulations of the combustion performance of burning the washed stoker coal in traveling-grate boilers.

## **FUTURE WORK**

- Collect a representative sample of raw coal from the Kazimierz-Julius mine, ship this sample to Penn State, and initiate the washability testing of raw coal and the boiler performance simulations on samples of the coal washed at a number of specific gravities.
- Continue to seek additional washed coal sales agreements.
- Complete the income/outlay information so that the "proforma" for the economics of the project can be finalized.

Because of the inordinately long length of time it has taken to negotiate long-term raw-coal supply contracts with Polish coal producers, a sixth 90-day no-cost time extension was requested from the Department of Energy for Budget Period I.

Permission to proceed to Budget Period II was approved in May, 1996.

The revised Gantt Chart shown in Figure 1 illustrates the status of the project at the end of this reporting period (June, 1996).

## **REFERENCES**

Taywood Mining, Inc., Birtley Modular Systems.

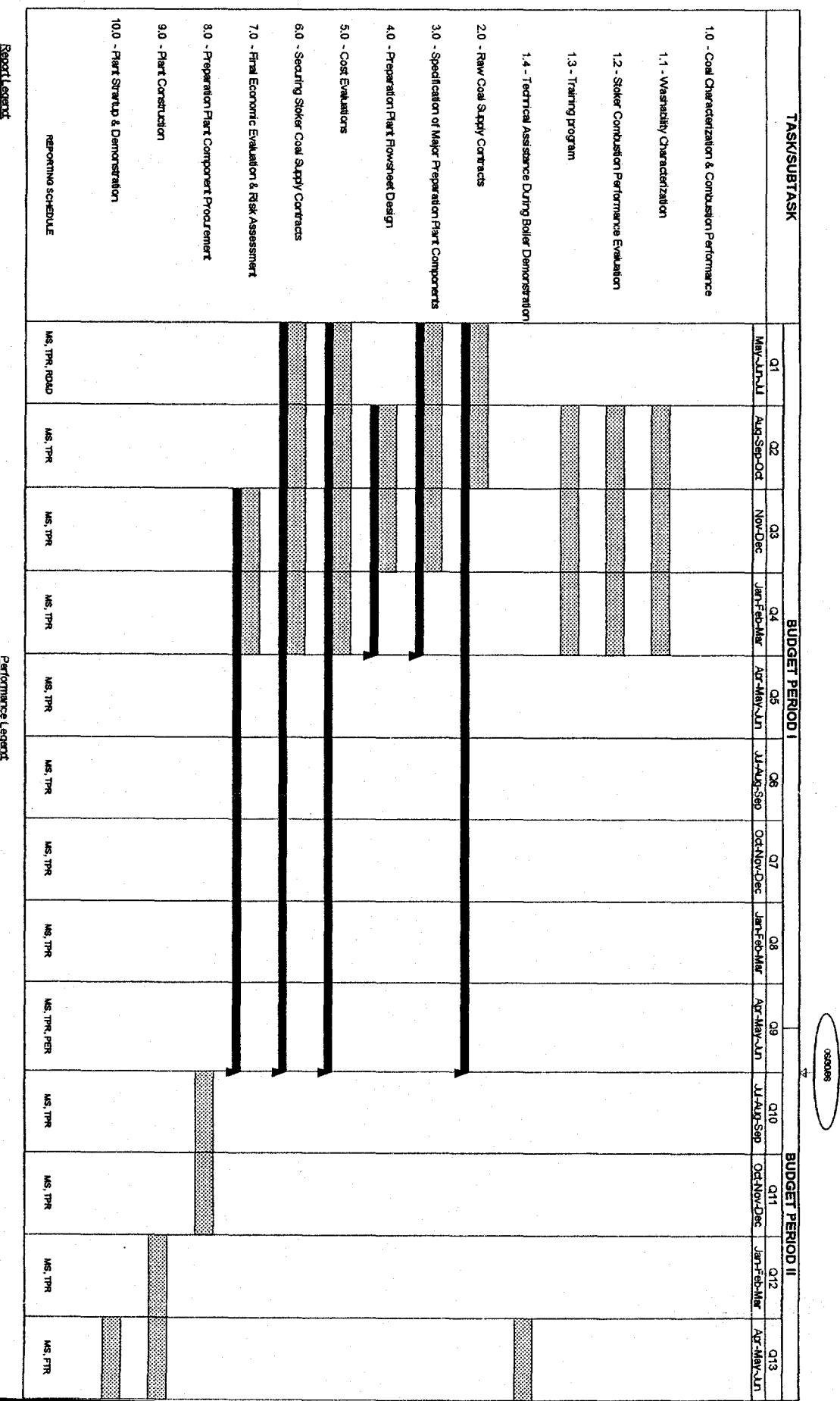
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**KRAKOW CLEAN FOSSIL FUELS AND ENERGY EFFICIENCY PROGRAM**  
**INSTALLATION OF A STOKER COAL PREPARATION PLANT IN KRAKOW, POLAND**

**Figure 1 - GANTT CHART**



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