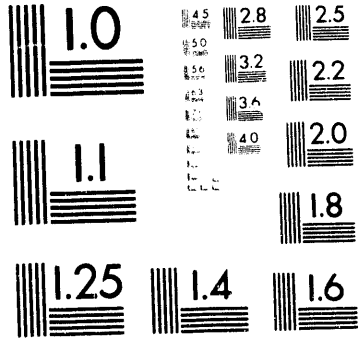
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DOE/PC/92205--T3

BENCH-SCALE TESTING OF THE MULTI-GRAVITY SEPARATOR IN COMBINATION WITH MICROCEL

Contract No: DE-AC22-92PC92205
Third Quarterly Report

Reporting Period:
April 1, 1993 to June 30, 1993

Prime Contractor:

Center for Coal and Minerals Processing
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061-0258

Subcontractors:

Carpco, Inc.
Roberts & Schaefer Company
Consolidation Coal Company
Kerr-McGee Coal Corporation

Prepared for:

Pittsburgh Energy Technology Center
U.S. Department of Energy
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Date Submitted: July 30, 1993

Contracting Officer's Representative: Carl Maronde

U.S./DOE Patent Clearance is not required prior to the publication of this document.

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DISCLAIMER

1.0 Abstract

Work this quarter primarily focused on procurement and fabrication of the required process equipment. Roberts & Schaefer managed this aspect of the project and has arranged for all equipment to be delivered to the job site during the first week of installation. All fabrication work is underway and is expected to be completed prior to the installation deadline.

Delays in the existing project within the CPPRF have resulted in a shift in the original project schedule. A new installation date (June 28, 1993) has been established by DOE/PETC. The overall project schedule has been adjusted accordingly. These changes are shown in the detailed project schedule on the following page.

Revisions to ESH subject plans were also completed during this quarter. Based on these plans, the ESH permitting procedure has been initiated by the contracting officer's representative. The subject plans and circuit will be modified, if necessary, to reflect any changes suggested by DOE. It is anticipated that the ESH permit will be issued in the early part of the third quarter.

Preliminary characterization studies continued this quarter. Modifications were made to the centrifugal washability procedure to minimize time material requirements. Using the modified procedure, tests were conducted on both the Pittsburgh #8 and Illinois #6 seam coals as a function of particle size.

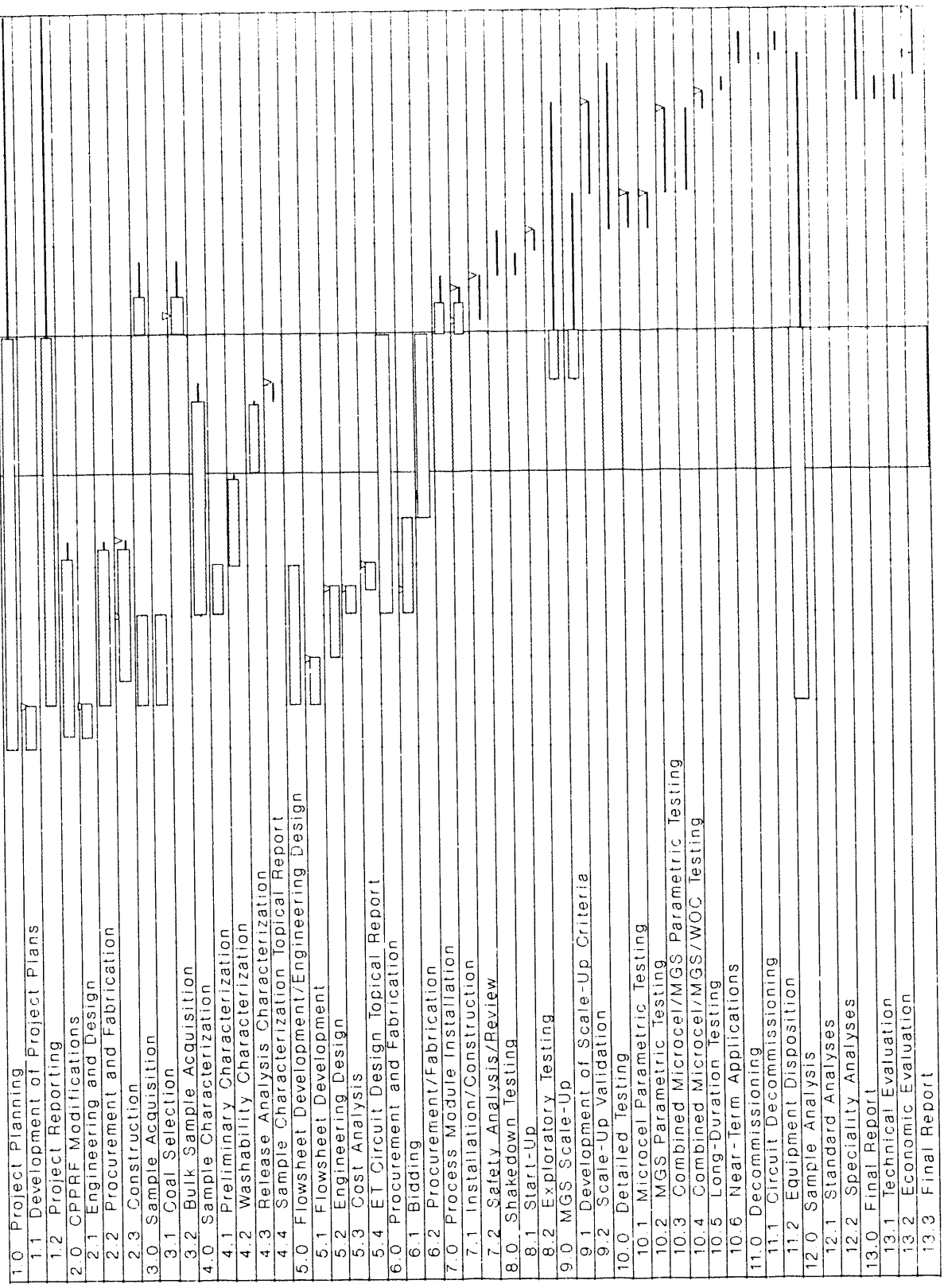
2.0 Project Objectives

The primary objective of the proposed work is to design, install, and operate an advanced fine coal processing circuit combining the Microcel and Multi-Gravity-Separator (MGS) technologies. Both of these processes have specific advantages as stand-alone units. For example, the Microcel column effectively removes ash-bearing mineral matter, while the MGS efficiently removes coal-pyrite composites. By combining both unit operations into a single processing circuit, synergistic advantages can be gained. As a result, this circuit arrangement has the potential to improve coal quality beyond that achieved using the individual technologies.

In addition to the primary objective, secondary objectives of the proposed test program include:

- *Circuit Optimization:* The performance of each unit operation, individually and combined, will be optimized by conducting parametric studies as a function of key operating variables. The goal of this work is to maximize the rejections of pyritic sulfur and ash while maintaining a high energy recovery.

Detailed Project Schedule/Milestone Identification Chart



- *Process Variability:* The steady-state performance of the optimized processing circuit will be studied (i) by conducting several long-duration test runs over a period of several days and (ii) by testing coal samples from other sources specified by the participating coal companies.

- *Process Evaluation:* Detailed technical and economic evaluations will be conducted to examine the feasibility of the proposed concept for fine coal cleaning on an industrial scale. This evaluation will include a projected cost-benefit analysis and a review of all test data, engineering analyses, scale-up procedures, and process deficiencies.

The test work will be conducted at the Pittsburgh Energy Technology Center's Coal Preparation Process Research Facility (CPPRF) located in Pittsburgh, Pennsylvania. The CPPRF is a state-of-the-art pilot-scale facility for coal preparation research and testing. The Emerging Technology (ET) section of the pilot plant will be used for testing the combined Microcel and MGS circuit. The ET area, and subsequently installed mezzanine, is adjacent to the pilot plant and was established for testing new and emerging technologies in coal preparation. This facility is ideally suited for pilot-scale test work due to the availability of all necessary ancillary facilities (i.e., bulk solids handling, preparation, and waste disposal). In addition, the necessary environmental, safety and health aspects related to the handling and disposal of waste are already in place.

3.0 Project Task Updates

3.1 Task 1.0 - Project Planning

3.1.1 *Project Reporting*

The required monthly project reports have been submitted as outlined in the final ***Project Work Plan***. These reports were submitted on the twenty-fifth of each month (starting in November, 1992) and include the following:

- Project Status Report
- Summary Report
- Milestone Schedule Status
- Cost Management Report

In addition, revised versions of the following topical reports were also submitted:

- ET Circuit - System Safety Analysis
- Nuclear Density Gauge - System Safety Analysis
- Operating Manual/SOP

3.1.2 *Project Meetings*

A pre-construction conference was held at PETC on June 28, 1993. The following representatives from the DOE, CCMP (prime contractor), Roberts & Schaefer (subcontractor; engineering) and Rizzo & Sons (subcontractor; construction) were present:

- *CCMP*: Jerry Luttrell - Associate Professor
  Mike Mankosa - Research Scientist
  Jerry Rose - Technician
  P. Venkatraman - Technician

- *Roberts & Schaefer*: Jerry DeMarino - Construction Manager

- *Rizzo & Sons*: John Rizzo Jr. - Construction Supervisor
  Duane Bash - Labor
  Joe Sumogyi - Labor
  Randy Shultz - Labor
  Mike Rizzo - Labor

- *DOE/PETC*: Carl Maronde - Contracting Officer's Representative
  Rick Killmeyer - Manager, Coal Preparation

The procedures and regulations governing work in the CPPRF were reviewed. These included facilities access, parking/laydown areas, work hours, available services, hot work permits, safety protocol, emergency procedures, accident/fire reporting, communication, material delivery, testing and disposal, dust/noise emissions, alarms, construction coordination/inspection and payroll verification (according to Davis-Bacon Act).

3.2 Task 2.0 - CPPRF Modifications

Work continued on the design of the raw coal receiving area. Several alternatives were presented to DOE. It was determined that the design modifications would include the following:

- Installation of a concrete pad and approach ramp to aliow trucks to dump directly into the raw coal receiving hopper.

- Removal of the existing raw coal feed system.

- Installation of a receiving hopper and 18-inch screw conveyor for feeding raw coal to the existing crushing circuit.

3.3 Task 4.0 - Sample Characterization

3.3.1 *Preliminary Characterization*

A variety of laboratory characterization studies are planned to evaluate the potential cleanability of the base coal samples. These include (at a minimum) centrifugal washability and release analysis. Preliminary plans include evaluating each coal at three different grind sizes (-28 mesh, -65 mesh and -200 mesh). In each case, a 90% passing size will be used as the defining criteria.

3.3.2 *Washability Characterization*

Washability characterization for both the Pittsburgh #8 and Illinois #6 seam coals were conducted during this quarter. This task was delayed due to a design modification to the centrifugal separator. The original Sharples high-G batch centrifuge was abandoned due to excessive cost, materials and time requirements. To minimize these requirements, several small batch centrifuge containers were constructed. A schematic diagram of the separatory container is shown in Figure 1.

The float/sink tests are conducted in a heavy liquid media consisting of Perchloroethylene, Dibromomethane and Percut. The liquids are combined to prepare solutions with specific gravities of 1.30, 1.35, 1.40, 1.60 and 2.00, respectively. A 2.5 gram sample is loaded into each centrifuge vial with the appropriate amount of heavy liquid and the samples centrifuged at 5000 rpm for 60 minutes. At the conclusion of each cycle, the vials are removed and a stopper placed in the V-neck. The two products are removed from the vial and subsequently filtered, dried, weighed and analyzed.

The float/sink products will be analyzed for moisture, ash, volatile matter, fixed carbon, heating content and pyritic and total sulfur. The analysis has not yet been completed. These results will be presented later in both the ***Preliminary Characterization Topical Report*** and the ***Fourth Quarterly Report***.

3.4 Task 6.0 - Procurement and Fabrication

3.4.1 *Procurement and Fabrication*

Procurement of process equipment continued during this quarter. Several items have been received and delivery dates have been established for the remaining equipment. Fabrication of the three major process sumps has been completed. These units will be stored at the fabricators site until the start of the installation phase of this project. Construction of the motor control center and control panel is on-going and is also expected to be completed prior to the start of installation.

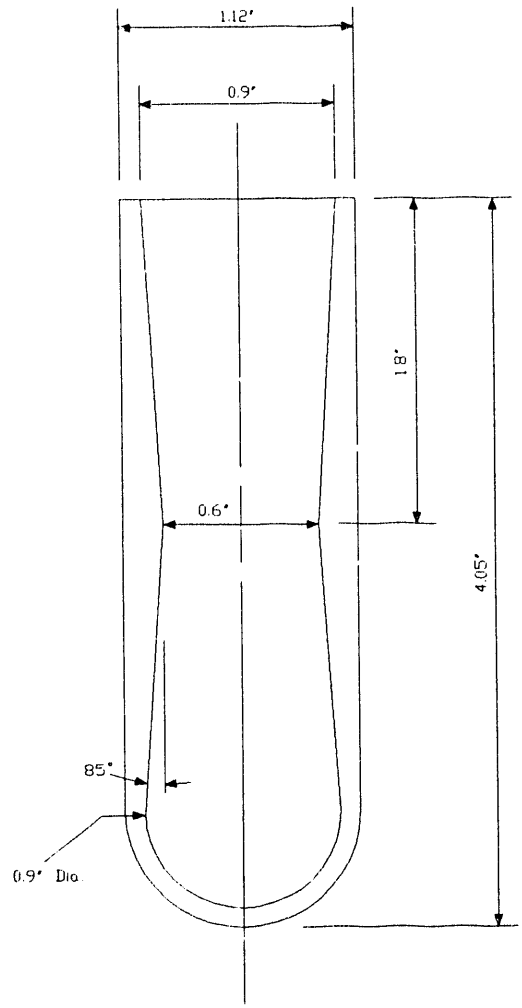


Figure 1. Schematic diagram of batch centrifuge vial.

3.5 Task 9.0 - MGS Scale-Up

3.5.1 *Development of Scale-Up Criteria*

Development of a process model for the MGS requires identification of the operating parameters which affect performance. A series of tests have been conducted at the CCMP to identify these parameters. Based on this study the following operating parameters have been identified.

- *Feed Rate* to the MGS impacts both mass loading and retention time; both of which influence performance. As with most equipment, preliminary findings indicate that an increase in feed rate results in a decrease in recovery.

- *Feed Percent Solids* also influences equipment performance. At a fixed volume feed rate, an increase in percent solids results in an increase in the mass loading of the unit; however, the process retention time will not change. Conversely, for a fixed mass feed rate of solids to the unit, an increase in percent solids results in a lower volume flow rate/higher retention time.

- *Wash Water*, added at the lip of the drum, prevents coarse, low density particles from discharging with the high density fraction. This mechanism parallels the cross-flow of wash water used on conventional shaking tables for recovery of the coarse particles.

- *Rotational Speed* controls the centrifugal field within the separator. The required drum speed is a function of the size and density of particles to be separated, i.e., finer particles typically require higher rotational speeds.

- *Tilt Angle* represents the angle of decline of the drum axis towards the low density product discharge end (typically 2-8 degrees). Tilt angle predominantly controls the rate at which material progresses through the drum. As a result, this parameter also influences the particle retention time.

3.6 Task 12.0 - Sample Analysis

3.5.1 *Standard Analysis*

Sample analysis is being conducted as required for the characterization studies. All samples are routinely analyzed for moisture, volatile matter, fixed carbon, ash, heating content, pyritic, and total sulfur content. Particle size analyses are being conducted as required to characterize the feed particle size distributions.

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