

DOE/ET/10815-229
DIST. CATEGORY UC-112
UTSI-95-02

**TECHNICAL PROGRESS REPORT
FOR
THE MAGNETOHYDRODYNAMICS
COAL-FIRED FLOW FACILITY**

For The Period
October 1, 1994 - December 31, 1994

January 1995

Work Performed Under Contract No. DE-AC02-79ET10815

Prepared for:
The United States Department of Energy

Prepared by:
The University of Tennessee
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Energy Conversion Research and Development Programs

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PREFACE

The purpose of this report is to provide the status of a multi-task research and development program in coal fired MHD/steam combined cycle power production. More detailed information on specific topics is presented in topical reports. Current emphasis is on evaluating technology for the Steam Bottoming Cycle Program. The approach taken was to design test components that simulate the most important process variables, such as gas temperature, chemical composition, tube metal temperature, particulate loading, etc., to gain test data needed for scale-up to larger size components.

Previous reports have provided comprehensive data on NO_x and SO_x control, radiant heat transfer, particulate control (baghouse and wet and dry electrostatic precipitators), environmental monitoring, and analyses of test data on the convective heat transfer components (superheater and air heater) with eastern, high sulfur coal firing. For this quarter, analyses of the data for previously completed eastern coal testing and western coal proof-of-concept (POC) tests continued, but was extremely limited due to the loss of personnel in downsizing the organization for program closeout. Detailed data analyses will be contained in test reports, topical reports or technical papers to the extent permitted by resources available.

Also during the quarter activities progressed toward readying the facility and equipment for disposition, fulfilling site environmental compliance and remediation requirements, and the preparation of data and documentation for archiving.

ABSTRACT

In this quarterly technical progress report, UTSI reports on the status of a multi-task contract to develop the technology for the steam bottoming portion of a MHD Steam Combined Cycle Power Plant. The report describes the facility maintenance and environmental work completed, status of completing technical reports and certain key administrative actions occurring during the quarter.

With program resources at a minimum to closeout the MHD program, no further testing occurred during the quarter, but the DOE CFFF facility was maintained in a standby status with winterization, preventive maintenance and repairs accomplished as needed. Plans and preparations progressed for environmental actions needed at the site to investigate and characterize the groundwater and for removal/disposal of asbestos in the cooling tower. Work continued to progress on archiving the results of the MHD program.

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SECTION I

OBJECTIVE AND SCOPE OF WORK

Under Contract No. DE-AC02-79ET10815, the overall objective initially was to advance the technology of direct coal-fired MHD components and systems required for MHD power generation operating under conditions simulating those of central power stations. The specific objectives of the DOE Coal-Fired Flow Facility (CFFF) were to resolve experimentally and analytically the key technical areas of concern identified or found to occur in direct coal-fired MHD systems with moderate to high ash carryover. The key areas involved (1) combustor performance, (2) ash/seed particle collection efficiency from the exhaust gas stream, (3) effects of plugging, fouling and corrosion during normal operation, (4) performance of candidate materials in a direct coal fired MHD environment and (5) the operation, conditions, procedures and equipment needed to meet pollution control requirements.

In view of the conclusion of the MHD proof-of-concept program and acquisition of data, DOE directed UTSI to take the following actions:

- a) contract closeout;
- b) property disposition;
- c) reporting and archiving of data; and
- d) environmental remediation

In support of the above objectives and the DOE FY1994 MHD Program Plan, a revised contract statement of work (SOW) and management plan were approved by DOE. The technical approach now focuses on the following four (4) tasks described below:

TASK I - Contract Management and Close Out

This task provides for the overall management of the program which entails the planning, organizing, scheduling, directing, coordinating and controlling of the resources required in the close out of the contract. Specific support staff functions include project control, reporting, accounting and financial affairs, government property administration, and contract administration.

TASK II - Facility and Property Disposition

This task provides for the maintenance of the CFFF in a standby condition until final disposition of the facility is made. All government owned property and equipment will be documented and controlled, and worn or unusable material will be recommended for applicable disposition.

TASK III - Data Reporting and Archiving

The contractor shall collect all data generated during the proof-of-concept testing program and place in a retrievable condition by identifying and documenting in accordance with its nature, format, quantity and repository. Data to be archived will be selected on the basis of certain criteria.

TASK IV - Site Environmental Compliance and Remediation

The Coal Fired Flow Facility site shall be subject to a DOE-directed project environmental characterization whereby site compliance and remediation requirements and actions will be identified and documented. The contractor shall accommodate this effort by providing accessibility to all pertinent areas and relative information and documentation as needed to perform the environmental characterization.

The contractor shall be prepared to perform the tasks necessary for site remediation and site restoration as determined by the site characterization study and as decided upon by the U.S. Department of Energy, and within the limitations of allocated costs.

CFFF PROGRAM GOALS AND SCHEDULE

Figure 1 shows the major program tasks presently scheduled/completed during the October through December 1994 period.

UTSI/CFFF MAJOR ACTIVITIES & SCHEDULE
OCTOBER 1, 1994 - SEPTEMBER 30, 1995

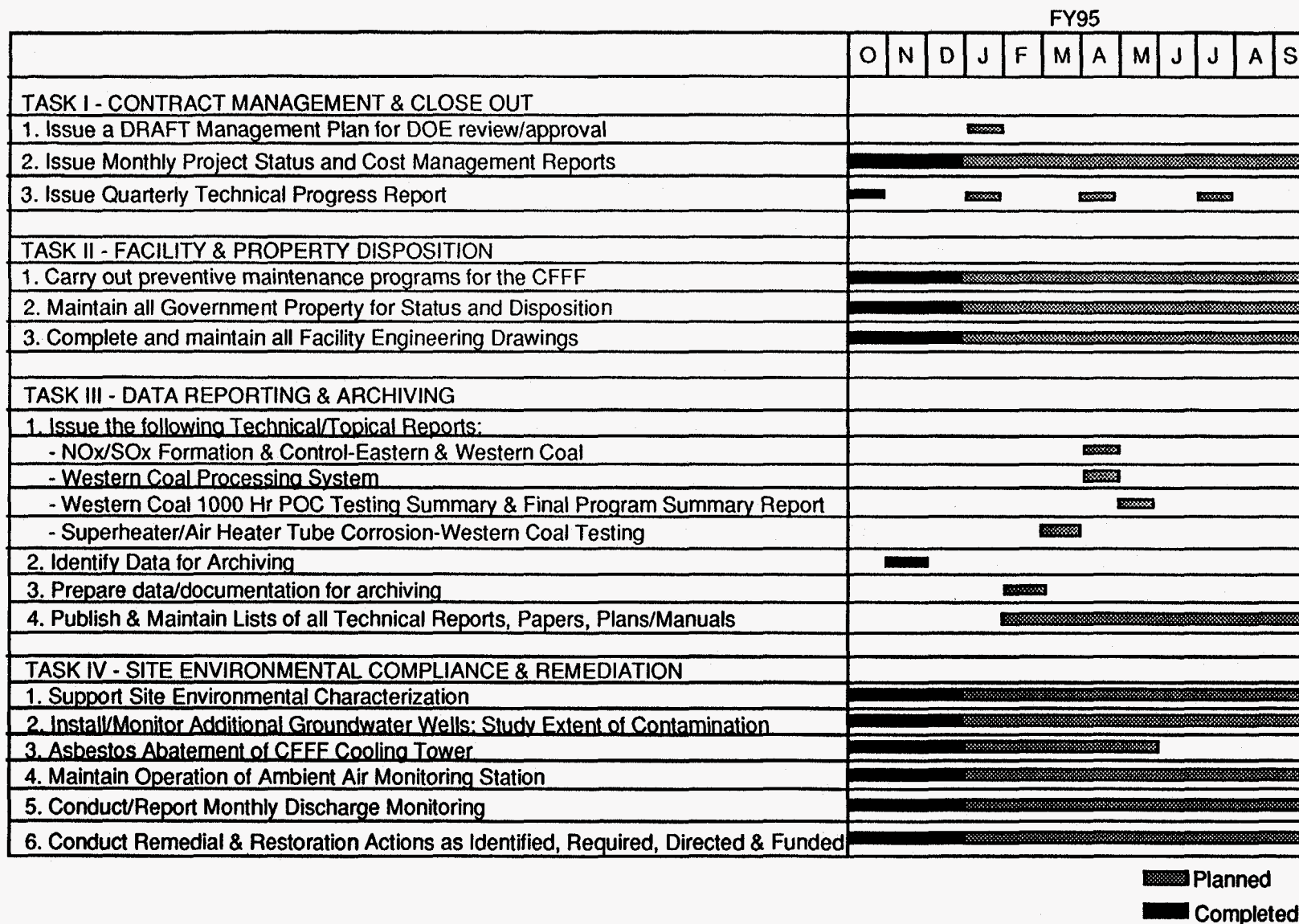


FIGURE 1. Scheduled Tasks

SECTION II

SUMMARY OF TECHNICAL PROGRESS

This section addresses the technical progress of work conducted during the period October 1 through December 31, 1994, according to the objectives and scope of work tasks outlined in Section I. Figure 2 is an overview of the DOE MHD Coal Fired Flow Facility (CFFF) at UTSI, and Figure 3 is a schematic of the current LMF test train.

TASK I - CONTRACT MANAGEMENT AND CLOSEOUT

The final July-September 1994 Quarterly Technical Progress Report was issued to DOE.

Monthly Contract Status Reports for September, October and November 1994 were prepared and sent to DOE.

Internal project plans and budgets to support the contract tasks for FY1995 were undergoing preparation and reviews.

The University's lease agreement with DOE to accommodate the CFFF was renewed for calendar year 1995.

Contract funding modification #A110 in the amount of \$500K was received to support operations through January 15, 1995.

A Management Plan for FY1995 was in preparation for submission to DOE. It should be issued in January 1995 and outline the work, milestone schedules and costs projected for FY95.

The Summary Subcontract Report (Small Business Program) for FY94 was prepared and sent to DOE.

Planning and solicitation of papers for the 33rd Symposium on the Engineering Aspects of MHD (SEAM) were carried out. SEAM 33 will be held at UTSI on June 13-15, 1995, along with UTSI's co-sponsor, ERC, Inc.

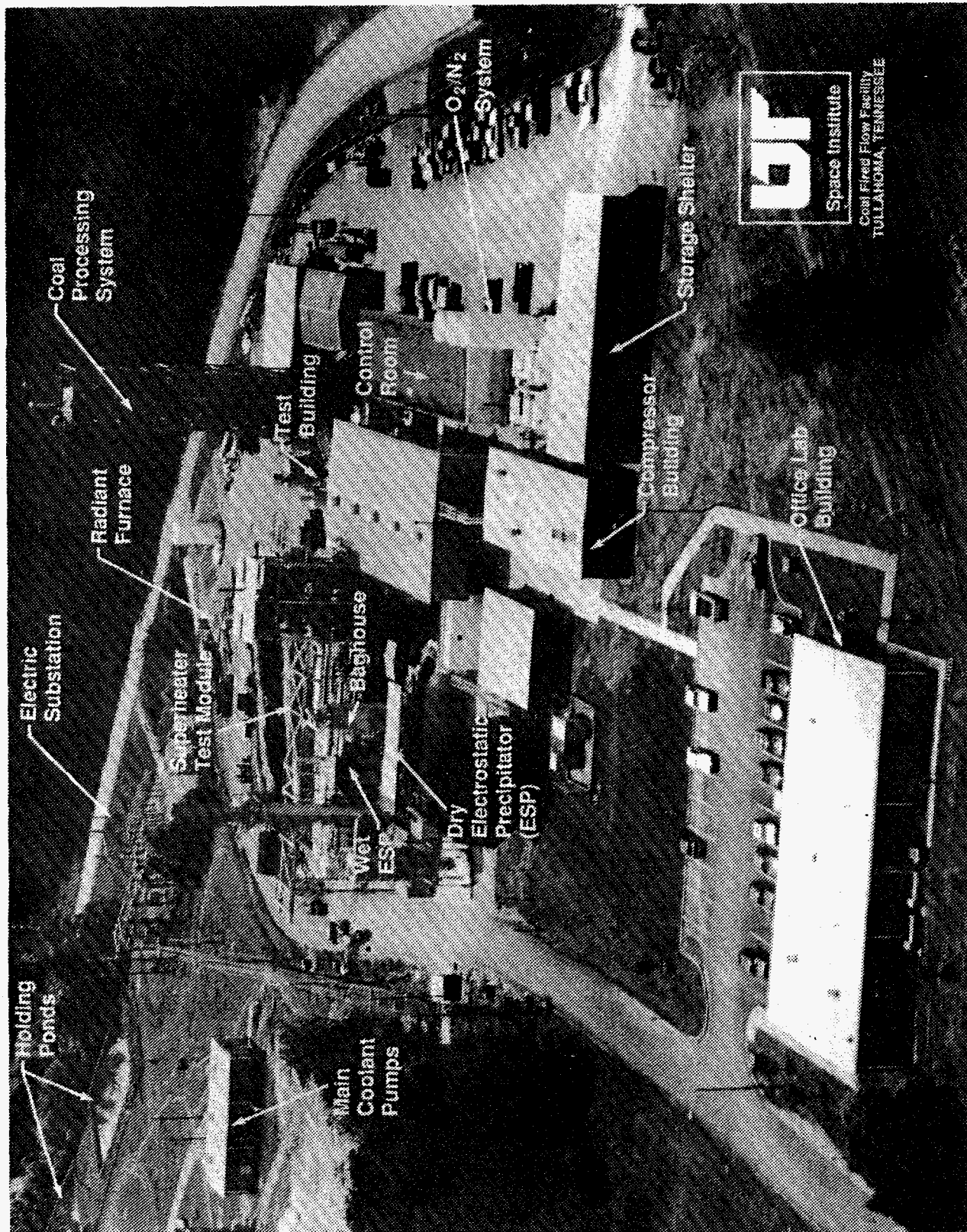


FIGURE 2. Overview of the Coal-Fired Flow Facility

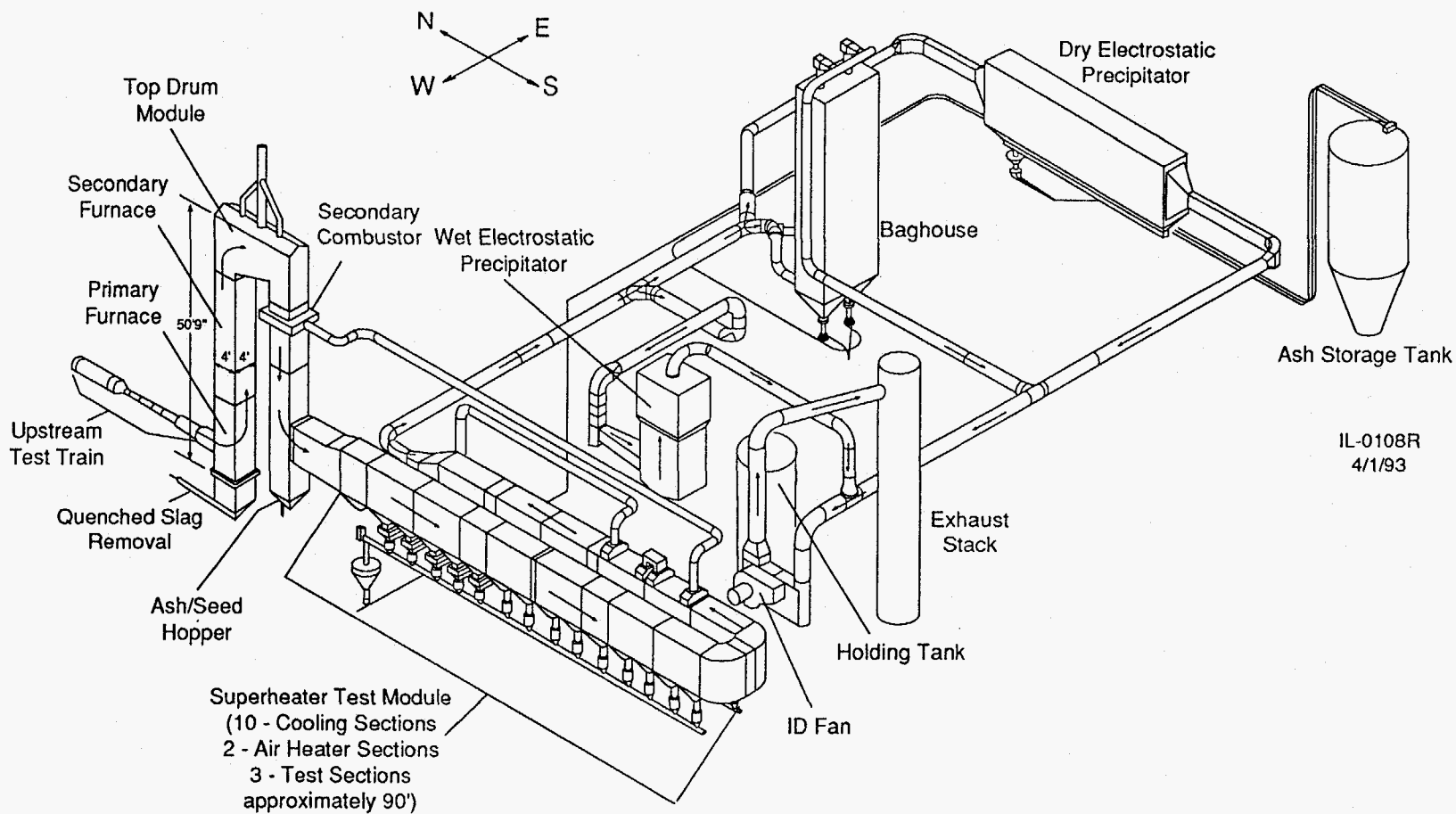


FIGURE 3. CFFF Integrated MHD Bottoming Cycle Schematic

TASK II - FACILITY AND PROPERTY DISPOSITION

No MHD testing was scheduled or performed during this quarterly period.

Activities this quarter were concentrated on facility winterization, preventive maintenance/ repair and completing a physical inventory of all government property. Weekly and monthly equipment maintenance procedures were performed for facility air compressor systems, cooling water pumps, coal processing system motors, steam boiler systems, ID and FD fans, and fire water system equipment.

As a preventive step, a replacement oil cooler was procured and installed in oxidizing air compressor #1. This preventive step was taken in response to the water-side corrosion that previously damaged the oil cooler in oxidizing air compressor #2.

A checkout of critical coal system components was completed this quarter. The pulverizer, main air blower, and air heater were operated successfully but several system valves were found to be inoperable and repairs were initiated.

CFFF process water cooling tower overhaul repair parts were received this quarter. A request for quotations was issued for removal and disposal of the asbestos containing air baffles. Interior and exterior corrosion damage to the cooling tower system will be repaired during the next three months. Facility winterization efforts were also initiated this quarter.

During this period, the following electrical and data system maintenance items were accomplished:

- Repaired facility power monitoring equipment.
- Performed periodic operational checkout and disk backups on the Data General MV1500 computers to maintain operation.
- Performed electrical/electronics repairs to CFFF plant equipment as necessary to maintain the operational capability. This includes equipment such as personal computers, data acquisition system components, heat tracing, and lighting.

A physical inventory of all government property was conducted. As a result of the inventory several items were identified and processed for retirement.

TASK III - DATA REPORTING AND ARCHIVING

The final issue of the Technical Summary Report for 2000 Hours of Testing on Eastern Coal was completed and distributed.

A study of the "Kinetics of Potassium and Sulfur in the Secondary Combustor" was in process. Published results of this study also will be incorporated in our archiving system.

Evaluation of the LMF5 Proof-of-Concept superheater test module tubes resumed. All tube samples previously prepared have been retrieved and microscopic analysis of each section will be conducted by analyzing for scale thickness and tube thickness.

Work continued on the evaluation of NO_x decomposition when using both eastern and western coals.

All data and documentation generated under the contract pertinent for archiving were identified according to its nature, format, quantity and repository.

TASK IV - SITE ENVIRONMENTAL COMPLIANCE AND REMEDIATION

With the completion of the shortened LMF5 POC test series, the only MHD related analytical services being conducted are those which support environmental monitoring and evaluation of materials, including maintenance of the chemistry laboratory as well. Safety procedures and equipment are being reviewed and upgraded or maintained as required. A full-time chemist is now available in the laboratory, with the majority of the funds for this position being supplied by contracts other than the MHD contract.

Monitoring and treatment of the holding pond effluent was conducted to comply with the UTSI water discharge permit. Water is checked for pH, temperature, flow rate, oil and grease content, total dissolved solids, and total suspended solids. All parameters are currently being measured by the UTSI chemistry lab. Any changes in CFFF operation would require monitoring of additional parameters.

A contract for the drilling of additional groundwater wells to investigate and characterize the groundwater surrounding the CFFF was in the process of being awarded. Weather permitting, work should start before February 1, 1995.

A contract for removal and disposal of the asbestos-containing cooling tower fill at the CFFF was also in process of award. The work should begin soon.

UTSI was still awaiting a response from DOE to its letter of March 18, 1994, containing planned action items and cost estimates for the disposal, site remediation and restoration for the CFFF and adjacent areas which was prepared in response to the DOE-conducted site environmental characterization audit held in March 1994.

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