

THE UNIVERSITY OF TENNESSEE  
SPACE INSTITUTE

DOE/PC/95231-1  
DIST. CATEGORY UC-112  
UTSI-96-01

APPROVED

TECHNICAL PROGRESS REPORT  
FOR  
UTSI/CFFF MHD PROGRAM COMPLETION  
AND RELATED ACTIVITY

For The Period  
September 1, 1995 - December 31, 1995

January 1996

Work Performed Under Contract No. DE-AC22-95PC95231

Prepared for  
The United States Department of Energy

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

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TULLAHOMA, TENNESSEE 37388-8897

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## COAL FIRED FLOW FACILITY

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## EXECUTIVE SUMMARY

The DOE Coal Fired Flow Facility (CFFF) is being maintained in a standby condition. In addition to routine preventative maintenance, a 1,000 MVA transformer failure occurred and repair actions are under consideration. Analyses and reporting in key areas of the MHD POC program continued. One topical report was completed during the quarter and three more plus a summary report for the Western coal tests are nearing completion. In addition, the data and test documentation from the over 3,000 hours of MHD testing on coal is in storage awaiting DOE instructions on location and format for archiving. Environmental activities include both actions required by the State of Tennessee for maintenance of permits and remedial actions identified by DOE that must be addressed. One of these remedial actions was completed this quarter with the removal and disposition of the asbestos from the CFFF cooling tower. The other remedial action reported is monitoring and studying the groundwater contaminants previously identified.

Work Plans were prepared for two new subtasks, subtasks 6.1 and 6.2, "High Temperature Superconducting (HTS) Plans" and "Staff Exchange and Training," respectively.

## **TASK 1 - FACILITY AND PROPERTY MANAGEMENT**

Activities this quarter were concentrated on the facility preventative maintenance/repairs required to maintain the Coal Fired Flow Facility in a standby condition. 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.

Repair work was initiated on the CFFF main substation and the cooling tower 1000 KVA power transformer. A suspected short in the cooling tower transformer severely damaged the transformer and caused minor damage to the main substation and disabled the Lake Pumphouse. A temporary power line was installed to the Lake Pumphouse until the cooling tower 1000 KVA power transformer, which normally supplies power to the Lake Pumphouse, can be repaired. A search was made among suppliers and local utility companies for a suitable replacement transformer but the search was not successful. Cost estimates were obtained from suppliers for installing a new transformer and also for repairing the damaged transformer. An evaluation is being made to determine the best approach.

The reconditioning of the CFFF process water cooling tower continued. The installation of the support steel is complete and replacement of the asbestos fill with PVC fill is 75 percent completed. The reconditioning of the CFFF process water cooling tower was temporarily halted until additional PVC fill material is delivered. It is expected that the fill material will arrive in January and the cooling tower reconditioning is expected to be completed in February.

The lease for cryogenic oxygen and nitrogen services with Praxair was terminated this quarter. Praxair technicians removed the three 12,000 gallon dewars (two liquid nitrogen and one liquid oxygen ) at CFFF but left all vaporization equipment in place. Since the vaporization equipment was not removed, the cryogenic services at CFFF can be more quickly restored when needed.

A physical inventory of CFFF government property was initiated this quarter and is expected to be completed in January. Fire protection system maintenance included installation of new bearings in the Lake Pumphouse jockey pump and the repair of the charging circuit on the No.2 diesel pump. The remote power monitoring unit at the CFFF substation was removed and returned to the manufacturer for repair under warranty.

The data acquisition system is being maintained in a powered up, ready state. There have been no major problems with this equipment. An occasional power outage causes the Data General minicomputers to shut down requiring a manual procedure to restore them to operational status. To minimize costs, repairs to the data acquisition system signal conditioning boards are being made on an as needed basis. Current

plans include replacing the centralized DAS and control system with a distributed control system (DCS) with funding from another DOE Program. An effort continues to define future requirements for test data acquisition at the CFFF. A database of anticipated requirements is being built and this database will be used to specify the replacement DCS.

A U. S. Department of Energy Semi-Annual Report of DOE-owned Plant and Capital Equipment was issued on December 15, 1995.

A report of the UTSI's "Contractor's Property Management System" was sent on December 22, 1995.

## **TASK 2 - REPORTING AND ARCHIVING**

A Topical Report entitled "Superheater/Intermediate Temperature Air Heater Tube Corrosion Tests in the MHD Coal Fired Flow Facility (Montana Rosebud POC Tests)" was completed and sent to DOE Chicago for review. In order to get this report out in a timely manner, the report covered corrosion evaluation of tubes from two of the three SHTM test sections only. Gas bead blasting of Test Section 3 tubes is being done in preparation for post-LMF5 ultrasonic thickness gauging at the 448 locations of pre-exposure measurements. Reporting of Test Section 3 results and conclusions will be as an addendum to the above Topical Report.

Work continued on the Topical Report on Western Coal Processing and should be completed and forwarded to DOE for approval next quarter.

Work continued on the NO<sub>x</sub> Topical Report and the Summary Report for POC testing with Western Coal. Both reports should be completed next quarter. A graduate student thesis entitled "Parameters Affecting Nitrogen Oxides in a Coal Fired MHD System" is being published as a student thesis. This reports treats the experimental data and relevant calculational analyses for a single test, LMF5-J.

The data related to Trace Elements for the Rosebud coal was analyzed and compared to the results published earlier for Eastern coal. A summary was prepared for inclusion in the summary report and continued to work on the data with a view toward a future report on this subject.

The data tapes from all CFFF tests remain in storage in tape racks in an environmentally controlled area. Test reports and express data reports are also in storage. Archiving these data and documents is awaiting designation by DOE of the location and scope of the MHD program repository.

All original drawings of the CFFF grounds, buildings and support systems have been updated, filed and cataloged. Paper, microfilm and computerized (AutoCAD)

versions are available of all drawings prepared over the last 10 years. Earlier drawings may be available only in paper and microfilm format.

Prepared and submitted the Management Plan covering Tasks 1 through 5. Prepared two Work Plans in response to Work Requests for subtasks 6.1 and 6.2, High Temperature Superconducting (HTS) Plans and Staff Exchange and Training, respectively.

Received contract modification 04 authorizing \$100,000 for Tasks 1 through 5.

A completed lease was signed by all parties for the property on which the DOE CFFF is located. The lease covers a four year period starting 1/1/96 and ending 12/31/99.

Prepared the September, October, November and December Monthly Contract Status Reports.

### **TASK 3 - SITE ENVIRONMENTAL COMPLIANCE AND REMEDIATION**

The CFFF holding ponds were monitored according to the National Pollutant Discharge Elimination System (NPDES) permit requirements with no out of limit parameters noted. The results of the pond monitoring were recorded on the "Discharge Monitoring Report" required by the State of Tennessee, and sent to the State. This report is required monthly.

An audit by the Tennessee Air Pollution Division was completed during the quarter with no violations noted. As noted in the monthly Contract Status Reports, The Air Pollution Control Division is in the process of issuing UTSI permit(s) under Title V of the Clean Air Act Amendment (CAAA) as a "conditional major". This basically allows the Institute to operate without being involved in the rather tedious Title V permitting process.

The asbestos fill in the CFFF cooling tower was removed and properly disposed of during the quarter. The asbestos removal portion of this work was completed under subcontract by the NEO Corporation, Chattanooga Office. Work on the cooling tower repair continues as reported above in Task 1.

Actions were taken to transfer the Specific Radiological License to the General category. The State of Tennessee Division of Radiological Health will begin processing this action during the month of January 1996, thus reducing the license fee charged by the State from \$600 per year to \$100 per year.

A graduate student in Chemical Engineering has identified the key contaminants found in the initial groundwater analyses. These parameters will be used to model the lines of constant concentration around the existing eight groundwater wells

(Concentration versus Time and Distance). This analysis will aid in and validate choices for the additional six wells to be drilled.

#### **TASK 4 - SITE REACTIVATION**

No work was scheduled or performed.

#### **TASK 5 - DISASSEMBLY AND DISMANTLEMENT (D&D) OF THE CFFF**

No work was scheduled or performed.

#### **TASK 6 - OTHER GOVERNMENT**

##### **Subtask 6.1 High Temperature Superconductivity (HTS) Plans**

Received Contract Modification 03 authorizing \$200,000 for initiation of this work.

Work was initiated on this task with subtask 6.1, which is to cover the development of a work plan for a three year period with the objective of facilitating and aiding the commercial development of thick film superconducting wires. In addition to the administrative work reported above, a meeting was held, in conjunction with DOE representatives from PETC and ORNL, with the Oak Ridge personnel who have patented one of the promising processes for production of thick film superconductors. A visit was made to Los Alamos National Laboratory (LANL) on December 12, 1995, in conjunction with PETC representatives to get their recommendations on approaches to commercializing the thick film high temperature superconductor technology.

##### **Subtask 6.2 Staff Exchange & Training**

Prepared Work Plan for Staff Exchange and Training in response to Work Request. The objective of the work plan is to develop the plans and schedule for exchange and training of staff from UTSI and appropriate staff from National Laboratories and other appropriate organizations.

#### **OPEN ITEMS**

- A. DOE: A number of property retirement notices are still pending at DOE/CH.
- B. UTSI: The following reporting actions were in process or preparation as of December 31, 1995.

Superheater/ITAH Tube Corrosion Studies  
Topical Report

Est. Completion 1/31/96

NO <sub>x</sub> Formation and Control, Topical Report	Est. Completion 3/31/96
Western Coal Processing System, Topical Report	Est. Completion 1/31/96
Western Coal 1000 Hour POC & Final Summary Report	Est. Completion 1/15/96

### **SUMMARY STATUS ASSESSMENT AND FORECAST**

The CFFF continues in standby condition as preventive maintenance and repairs are accomplished.

Task 6.1 High Temperature Superconductivity (HTS) Plans is continuing to be developed.

Task 6.2 - Staff Exchange and Training. A work plan was developed and submitted to DOE/PETC in response to a Work Request.

### **TASK AND COST VARIANCES**

- Although the budget is prepared on an accrual basis, the University charges are on a cash basis. Therefore, charges will lag planned figures by one month.
- Expenditures lag plan since the funding authorized is less than the planned budget.
- The expenditures for Task 2 - Reporting and Archiving were greater than planned due to concentration of work efforts to complete MHD POC reports.
- Funding for work on Tasks 4 and 5 has not been authorized. Therefore, no work has been performed on these tasks.
- Funding for work on Task 6 was received in December, 3 months later than original planned start date.
- Corrective Actions - Corrective actions in the form of rebudgeting will take place as soon as the Federal Budget for FY 96 stabilizes and funding authorizations are issued.

SEPTEMBER 15, 1995 - DECEMBER 31, 1995 QUARTERLY VARIANCE REPORT

Planned vs. Actual Expenditures  
(thousands of dollars)

TASK	PLANNED	ACTUALS	VARIANCE
1	175.6	126.1	49.5
2	139.2	195.5	-56.3
3	82.2	31.3	50.9
4	38.0	0.0	38.0
5	30.4	0.0	30.4
6	293.4	5.3	288.1
TOTALS	758.8	358.2	400.6
COST ELEMENT			
DIRECT LABOR	304.6	192.7	111.9
FRINGE	76.5	45.9	30.6
EQUIPMENT	84.0	0.0	84.0
EXPENDABLE MATERIAL	44.8	0.1	44.7
OUTSIDE CONTRACTS	13.5	0.0	13.5
TRAVEL	10.5	0.1	10.4
TOTAL DIRECT COSTS	533.9	238.8	295.1
INDIRECT COSTS	224.9	119.4	105.5
TOTAL	758.8	358.2	400.6

Planned vs. Authorized Funding

TASK	PLANNED	AUTHORIZED FUNDING
1	175.6	
2	139.2	
3	82.2	
4	38.0	
5	30.4	
SUBTOTAL	465.4	256.4
6	293.4	100.0
TOTAL	758.8	356.4