DOE/ID/12735--T18

2DOE-MHD-D169

DOE/ID/12735--T18

DE92 000396

MAGNETOHYDRODYNAMIC PROJECTS AT THE CDIF

Quarterly Technical Progress Report
for
January 1 - March 31, 1991

PREPARED BY

MSE, Inc.
P.O. Box 3767
Butte, Montana 59702

PREPARED FOR

U.S. Department of Energy
Under Contract DE-AC07-88ID12735

MASTER

Approved by: J. M. Sherick
General Manager

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

ABSTRACT

This quarterly technical progress report presents the tasks accomplished at the Component Development and Integration Facility during the second quarter of FY91. Areas of technical progress this quarter included:

- coal system development;
- seed system development;
- test bay modification;
- channel power dissipation and distribution system development;
- oxygen system storage upgrade;
- iron-core magnet thermal protection system checkout;
- TRW slag rejector/CDIF slag removal project;
- stack gas/environmental compliance upgrade;
- coal-fired combustor support;
- 1A channels fabrication and assembly;
- support of Mississippi State University diagnostic testing;
- test operations and results;
- data analysis and modeling;
- technical papers; and
- projected activities.

TABLE OF CONTENTS

1.0 INTRODUCTION

The Component Development and Integration Facility (CDIF) is a major U.S. Department of Energy magnetohydrodynamic (MHD) test facility in Butte, Montana. The CDIF is operated by MSE, Inc. Within the national MHD program, MSE personnel are responsible for performing integration testing of vendor-supplied MHD power train components at the CDIF to support the goal of commercialization.

During the second quarter of FY91, MHD testing and testing to obtain material and design information was reinitiated, and channel coupon replacement was completed. Before the end of the quarter, testing was shut down when a water leak on the magnet was discovered. The channel was removed for channel coupon inspection and replacement and channel refurbishment, and phase II of the slag rejector installation was initiated. Pending completion of Phase II slag rejector installation, channel refurbishment, and magnet repair, testing will resume.

2.0 TASK DEFINITION

- Task 1 -- Facility;
- Task 2 -- Test Hardware/Support; and
- Task 3 -- Test Operation.

2.1 TASK 1 -- FACILITY

This task encompassed modifications and enhancements to plant systems that support testing, including checkout, testing, and characterization.

Subtasks for the facility task were:

- Subtask 1A -- Coal System Development;
- Subtask 1B -- Seed System Development;
- Subtask 1C -- Test Bay Modification;
- Subtask 1D -- Channel Power Dissipation and Distribution System (CPDDS) Development;
- Subtask 1E -- Integrated Topping Cycle (ITC) Current Consolidators;
- Subtask 1F -- Solid Suspension Injection System Upgrade;
- Subtask 1G -- Oxygen System Storage Upgrade;
- Subtask 1H -- Iron-Core Magnet (ICM) Thermal Protection System Checkout; and
- Subtask 1I -- TRW Slag Rejector/CDIF Slag Removal Project.

2.1.1 Subtask 1A -- Coal System Development

The following progress has been made during seed system development.

Engineering work began on four of the eight coal-related projects that were budgeted and scheduled. An informational design review was completed on the Scalping Screen and Vent Lines Project.

Although a purchase order has been issued to have A. B. Raymond analyze and perform a mass balance on the CDIF coal processing system, they were unable to perform the analysis as scheduled during MHD testing. Efforts to schedule the analysis during MHD testing continues.

An outside laboratory facility attempted to locate two firms that could prepare a tailored-size coal batch for testing at the CDIF. No outside firms were found that could provide the tailored-size coal batch; therefore, complete responsibility for any further actions related to the tailored-size coal was assumed by TRW.

2.1.2 Subtask 1B -- Seed System Development

The following progress was made during seed system development.

- Seed samples were obtained from the delivery truck, the bottom of the storage silo, and the scalping screen; two of the three laboratory analyses are complete. The MSE laboratory is in the process of purchasing a tool that will provide analysis of the third sample.
- Design work for converting the fly ash storage bin to a seed dust collector is approximately 80 percent complete.
- The Title I package for rerouting the seed storage silo discharge piping is 50 percent complete.
- Design work for providing a nitrogen purge (one of the miscellaneous modifications) to the inlet of the seed transfer blower is 60 percent complete.

2.1.3 Subtask 1C -- Test Bay Modification

This subtask is an ongoing effort to support the CDIF Test Program. Test bay modification will continue to evolve as testing progresses, new objectives are set, and new tests are defined.

During the past quarter, the conceptual design review for the test train/A-Bay modifications was held. The test train/A-Bay modifications project consists of the following subtasks:

- workhorse combustor and channel removal;

- integrated topping cycle (ITC) proof-of-concept (POC) combustor and channel installation;
- primary cooling water modifications;
- low-pressure cooling system installation;
- test train instrumentation; and
- process flow piping modifications.

The Title I design is scheduled to be completed June 1991, and Title II design is scheduled to be completed in September 1991. Installation of the ITC POC combustor is scheduled to be completed in March 1992, and installation of the $1A_4$ channel is scheduled to be completed in May 1992.

2.1.4 Subtask 1D -- Channel Power Dissipation and Distribution System (CPDDS) Development

The CPDDS consists of the resistive load bank, high-voltage room (HVR), inverter, voltage limiting device, and wiring from the HVR to the MHD channel connectors. The following progress was made in the CPDDS this quarter.

- Designed several power configuration/special instrumentation work packages and provided test support for MHD tests 91-CHEK-2, 91-MATL-4, 91-MATL-5, 91-MATL-7, AND 91-MATL-8.
- Provided engineering support for troubleshooting, fault determination, and repair to the HVR and meter panel. Damage was caused by shorted channel wire bundles, which caused arcing and smoke in one row on the meter panel during test 91-MATL-7. In addition, thermally stressed components were discovered in the HVR, which were caused by an open anode channel connector. The components were removed and replaced.
- Ordered capacitors for inverter filter C-1 and replaced capacitors that were loaned from the Montana Power Company and were temporarily installed in the inverter. The loaned capacitors were returned to the Montana Power Company.
- Removed several special instrumentation work packages (segmented electrodes and extended transverse and transverse), which were installed on high-voltage panels in the HVR; changes in channel construction removed the requirements for the instrumentation.
- Reviewed CPDDS preventive maintenance instructions (PMIs), added corrections as needed, and created new PMIs for various subsystems of the CPDDS.

2.1.5 Subtask 1E -- Integrated Topping Cycle (ITC) Current Consolidators

The conceptual design for the current consolidators (KCs) was presented to the MSE Design Review Committee on February 1; submitted comments were reviewed and will be incorporated into the Title I design. Title I design continued through the month of March, and a Title I design presentation has been scheduled for May 9.

A document specifying the interfaces required for installation of the KCs was written by MSE and Westinghouse and incorporated in the Title I design package.

The Westinghouse Critical Design Review on the KC design held on February 22 produced no major action items.

2.1.6 Subtask 1F -- Solid Suspension Injection System Upgrade

A preliminary design was prepared for upgrading the solid suspension injection system. The project plan and design documents are undergoing in-house review.

The scope of this project includes installing four additional progressive cavity pumps to meet the TRW requirement of 1 to 4 pounds per minute injection rates at each combustor port. Instrumentation will be installed to 1) monitor flow rates from each progressive cavity pump, and 2) monitor injection pressures at each port.

2.1.7 Subtask 1G -- Oxygen System Storage Upgrade

A preproposal meeting during the final bidding phase of the construction subcontract was held the first part of January. Three acceptable subcontract bids were submitted, evaluation was completed, and DOE-ID approval was received. The notice-to-proceed was given on March 11, and preconstruction activities were initiated. Structural support foundation excavation and the subsequent concrete placement was completed by the subcontractor. Subcontract submittal activity began; that review and evaluation/approval cycle will continue in support of construction activities. The two 55,000-gallon liquid oxygen storage tanks were received March 28. Arrangements for off-loading the tanks from the rail cars were completed, and the tank unloading is scheduled for the first week in April.

2.1.8 Subtask 1H -- Iron-Core Magnet (ICM) Thermal Protection System Checkout

No activity took place under this subtask this reporting period.

2.1.9 Subtask 1I -- TRW Slag Rejector/CDIF Slag Removal Project

The TRW slag rejector consists of a slag grinder assembly, a dense-phase pneumatic transport vessel, and an atmospheric collection tank with interconnecting valves and piping. As it is currently being designed, the CDIF slag removal system will consist of a dewatering conveyor and a dense-phase pneumatic transport system as well as the associated mechanical, electrical, and control systems. The slag removal system will dewater, weigh, and transport the slag out of Building 60 to disposal receptacles. When installed, the slag rejector/removal equipment will provide batch removal and slag weighing from the TRW 50-MW_t coal-fired combustor to support extended duration testing.

Activities this past quarter include:

- Completing engineering work for the Phase II mechanical package and instrumentation and control (I&C) installation package.
- Starting installation of the piping, electric power, and controls for automatic and manual operation of the dense-phase pneumatic transport vessel, atmospheric collection tank, and air receivers.
- Completing the I&C rip-out of the C2 console.
- Continuing Title II design work for Phase III of the project.
- Issuing the performance specification for the slag removal system.
- Continuing development of a procurement specification for the dewatering screw conveyor.

2.2 TASK 2 -- TEST HARDWARE/SUPPORT

Test hardware is supplied under a Department of Energy contract and is tested at the CDIF. During the test program, hardware design modifications and repairs are accomplished by MSE personnel at the request of the component developer. Facility test hardware interface refinements are also part of this task. Subtasks for the test hardware/support task were:

- Subtask 2A -- Stack Gas/Environmental Compliance Upgrade;
- Subtask 2B -- Coal-Fired Combustor (CFC) Support;
- Subtask 2C -- 1A Channels Fabrication and Assembly;
- Subtask 2D -- Unassigned;
- Subtask 2E -- Unassigned; and
- Subtask 2F -- Support of Mississippi State University (MSU) Diagnostic Testing.

2.2.1 Subtask 2A -- Stack Gas/Environmental Compliance Upgrade

This upgrade provides a permanent facility for collecting and analyzing off gases from any process tested at the CDIF. It will also give the CDIF the needed modification to comply with the required safety standards for storing and dispensing compressed gases and to comply with the CDIF air quality permit for POC operators.

Construction was completed on the Stack Gas Analysis Facility, and the Compressed Gas Storage Facility was delivered and set in place. Work continues on moving equipment into the new facility and constructing a remote calibration manifold.

On completion of construction, an independent relative accuracy test audit will be performed on the continuous emissions monitoring system so system certification can be attained.

Work is continuing on analyzing the off gases for carbon monoxide, carbon dioxide, and oxygen on a dry basis and sulfur dioxide, carbon monoxide, and nitrogen oxide on a wet basis. Efforts to remove the asbestos from the Gas Chromatograph were unsuccessful, and the Gas Chromatograph will be removed from service. Consequently, a thermal conductivity analyzer will be installed to measure hydrogen on a dry basis, after which, nitrogen values can then be obtained through material balance calculations.

2.2.2 Subtask 2B -- Coal-Fired Combustor (CFC) Support

Second-stage assembly was completed, and the CFC was prepared for testing in early January. When testing was shut down in February, the combustor was disassembled. The hot-walled filler section, which simulated heat fluxes of the high temperature, high-pressure cooling system, was removed and examined for gas-side corrosion. Various second-stage frames were removed and sent to TRW for evaluation.

A new CFC head end plate, a coupon filler section, and the second-stage frames were sent to MSE for installation. The second-stage was reassembled and installed, and the other components will be installed when the replacement CFC pintle arrives. An alternate cooling method is being designed by TRW.

2.2.3 Subtask 2C -- 1A Channels Fabrication and Assembly

The materials test channel was again installed into the test train on January 11. This channel contained all of the new Avco test bars and Z-bar sections in the right and left forward sidewall section. The channel consisted of wall sections 57, 50, 19, 20, 29, 30, 31, and 32. The thermal and electrical power test history of these wall sections is shown in Table 1.

TABLE 1 -- CHANNEL WALL SECTIONS IN SERVICE DURING QUARTER

WALL SECTION NUMBER	DESCRIPTION	COAL HOURS	POWER HOURS
57	FORWARD ANODE	27:18	22:30
50	AFT ANODE	27:18	22:30
19	FORWARD CATHODE	260:39	153:44
20	AFT CATHODE	260:39	153:44
29	FORWARD RIGHT SIDEWALL	27:18	22:30
30	AFT RIGHT SIDEWALL	243:16	146:14
31	FORWARD LEFT SIDEWALL	97:34	57:24
32	AFT LEFT SIDEWALL	243:16	146:14

The channel was removed from test service on February 8 after 22 hours 30 minutes of electrical power generation. All anode test bars and sidewall test bars were removed and shipped to Avco for evaluation and input into their channel design review update, which was held on February 19 in Pittsburgh.

All test bars that were shipped to Avco (with the exception of several molybdenum Z-bars) were received back at the CDIF by March 18 and were reinstalled into the materials test channel. This channel, which will go into test service next quarter, will consist of wall sections 49, 58, 19, 20, 29, 30, 31, and 32. Selected elements from the sidewalls were refurbished for this test series.

The fabrication of the aft subsonic and forward horizontal subsonic diffuser wall sections were completed and installed into the diffuser.

In-house fabrication of replacement diffuser sections continues. Replacement sections for the aft subsonic section are approximately 75 percent complete.

2.2.4 Subtask 2D -- Unassigned

2.2.5 Subtask 2E -- Unassigned

2.2.6 Subtask 2F -- Support of Mississippi State University (MSU) Diagnostic Testing

No activity took place under this subtask during this reporting period.

2.3 TASK 3 -- TEST OPERATION

The subtasks for the test operation task were:

- Subtask 3A -- Test Operations and Results;
- Subtask 3B -- Unassigned; and
- Subtask 3C -- Data Analysis and Modeling.

2.3.1 Subtask 3A -- Test Operations and Results

Facility checkout was completed, and channel coupon testing was reinitiated. Test objectives addressed during the quarter included:

- Checking out low-stress reference operating condition (N/O = 0.76) prior to longer duration conductivity and power testing.
- Checking out the new channel installation with the new Z-bar sidewall and 0.7 pitch coupons.
- Checking out the Avco iron-oxide-injection frame.
- Checking out the new slag rejection system isolators.
- Checking out the facility after shutdown.
- Supporting MSU diagnostic data gathering.
- Obtaining long-duration test data on power degradation with iron oxide injection and precombustor fouling during a continuous electrical generation test.
- Confirming the proposed $1A_4$ channel element materials, pitch, and braze design on both plasma side and water side using the materials test channel.

Testing this quarter included six tests for a total coal burn time of 27 hours 18 minutes and a total power time of 22 hours 30 minutes. Table 2 outlines the tests run during the quarter.

As a result of testing, observations were made, and theories were formed. The following addresses some of the observations.

Test 91-CHEK-2 was the first MHD test after a shutdown of approximately 6 weeks. The modifications made to the facility during the shutdown performed without problems, the electrical configuration modifications worked according to design, and the current controls (CCs) in this area had no trouble maintaining control. The only deviation from expectation was the degree of circulating current in the four pairs of cathodes tied together to a single anode (i.e., C87-C88, C89-C90, C91-C92, C93-C94). In each of these four cases, the aft cathode supplied the majority of the

TABLE 2 -- MHD TESTS

DATE	TEST NO.	TEST OBJECTIVES	COAL BURN TIME (hr:min)	ENERGY GENERATED (MW hr)	PEAK POWER (MWe)	POWER RUN TIME (hr:min)	COMMENTS
01/17/91	91-CHEK-2	1) Check out low-stress reference operating condition (N/O = 0.76), prior to longer duration conductivity and power testing. 2) Check out the new channel installation with the new Z wall and 0.7 pitch coupons. 3) Check out the Avco iron-oxide-injection frame. 4) Check out new slag rejection system isolators. 5) Check out th facility after shutdown. 6) Support MSU diagnostic data gathering.	04:07	2.43	1.19	02:40	Test objectives were met, and the facility operated well. Future testing will include the low-stress-reference operating condition (N/O = 0.76).
01/22/91	91-MATL-4	1) Obtain long-duration test data on power degradation with iron injection and precombustor fouling during a continous electrical generation test. 2) Confirm the proposed 1A$_4$ channel element materials, pitch, and braze design on both plasmaside and waterside using the materials test channel. 3) Support MSU diagnostic data gathering.	04:02	1.85	1.09	02:43	Test objectives were partially met. Testing was shut down by the channel integrity monitor arc detection. A post-test investigation revealed arcing from a channel wire to a pressure tap--the minor damage was repaired.
01/24/91	91-MATL-5	1) Same as 91-MATL-4.	04:38	2.60	1.20	03:42	Test objectives were partially met. Testing was shut down because the seed system was empty and could not be replenished from the storage silo, and the blue vessel flow could not be maintained. Following the test, the seed system was replenished, but additional flow from the storage silo could not be guaranteed.
01/29/91	91-MATL-6	1) Same as 91-MATL-4.	11:10	10.40	1.40	10:49	Test objectives were partially met. Coal flow was erratic during some of the test. An iron oxide pump was lost toward the end of the test, and, as a result, high intercathode voltages were experienced. Increases in iron oxide flow rate using the remaining iron oxide pump failed to compensate for the lost pump. Testing was shut down when the combustor tripped on low CFPC coal flow. Post-test inspection revealed a plugged pinch valve, which was attributed to a failed coal primary injector screen. The screen was replaced.
02/02/91	91-MATL-7	1) Same as 91-MATL-4.	00:33	0.14	1.13	00:19	Test objectives were not met. Testing was shut down by a manual emergency system shutdown due to arcing in both the test bay and the control room. The arcing was attributed to a failed wire bundle just below the diffuser. Minor damage was sustained at the wire bundle and in the control room where two voltage meters were destroyed.
02/07/91	91-MATL-8	1) Same as 91-MATL-4.	02:48	1.95	1.2	02:17	Test objectives were partially met. Coal flow was high during most of the test, due to the method being used to keep the CFPC pinch valve opened. One iron oxide pump failed. The combustor tripped because of low CFPC coal flow, which was attributed to a plugged pinch valve. Preparations were being made to restart the test when a cooling water leak was discovered on the magnet. Testing was secured.

current, including, in some cases, making up for reverse current flow in the forward cathode, which was acting as a local anode.

The new progressive cavity iron oxide pumps worked well, and data matched with previous data for flow rate versus cathode wall segmentation. As an experiment late in the test, one pump was secured, and the other pump was set to the original flow rate of the combined pumps (each pump was connected to a single port on the cathode side). Although the data is limited, it appeared (as expected) that this simulation of a plugged port with single pump configuration is indicated the same as a too low flow rate without plugging condition.

During test 91-MATL-4, two electrical problems affected the test.

The first problem occurred because of open wires from anodes A140 and A141. The condition was traced to a channel connector with a broken lock ring that had backed apart. Early indications, as the magnet was being brought up to warmup amperage, showed reduced current flow on these circuits; however, the CCs were still able to push current through. However, within a few minutes, the circuit became completely open. Power production was shut down, temporary repairs were done, and the lock ring was replaced subsequent to test shutdown.

The second electrical problem was more serious and caused the test to be terminated. The wire from cathode C182, which exits from the rear of the magnet bore, was apparently pressed against some hardware used for the pressure tap measurement at C246. The pressure and vibration caused the wire insulation to be penetrated, which allowed electrical contact of the wire and pressure tap. The voltage difference between the two is estimated to have been between 1,500 and 1,600 volts. The penetration and subsequent current flow caused the wire to vaporize. The light from this was detected by the channel integrity monitor (CIM), which caused an immediate emergency system shutdown.

Due to the rapid CIM detection and emergency shutdown, damage was minimal and was repaired the next day. Additional details of the failure were published in the test report for test 91-MATL-4.

During test 91-MATL-5, CC circuits associated with anode-cathode links A140-C125 and A141-C126 (Cabinet 2, Group 4, Slaves 2 and 3, respectively) were found to be inoperable as the electrical portion of the test was started. These circuits were associated with the open circuit condition that occurred in test 91-MATL-4 when the channel connector for anodes A140 and A141 backed apart. After the CC circuits were repaired, the test was continued and accumulated two more startups and over 1-1/2 hours of power without any difficulties noted. Subsequent to the difficulties on this test, the data from the previous test was examined more closely. This data revealed that the two CC circuits in question were not controlling as well as typical circuits do. There were numerous instances where the deviation from the group mean exceeded 10 percent over a 1-minute average, which is normally a rare event.

but is not usually considered a sign of failure. It is not clear why an open circuit should cause the CC circuits to fail, and it is also not clear what failure mechanism results in a delayed or slow failure.

Another CC circuit that did not function properly during test 91-MATL-5 was Cabinet 3, Group 3, Slave 11, which is associated with the A197-C182 link. This circuit (both the driver board and power module) was replaced after the last test because of the electrical fault on C182. Post-test inspection revealed that the newly installed driver board was defective.

During test 91-MATL-6, the coal flow instabilities experienced showed the complex electro-chemical balance involved in using iron oxide slurry to maintain a properly segmented cathode wall. Whenever conditions were off-nominal, high-intercathode voltages were observed, and without changing iron oxide flow rates, those high voltages diminished when conditions were restored to nominal. What specifically is happening inside the channel to produce this effect is unclear.

Generally, the CCs operated well. During times of unstable coal flow when the power levels fluctuated greatly, various alarms were received from the Data Acquisition System (DAS). The alarms cleared within a short time, and no alarms were noted during stable periods. The majority of deviations from the group average currents were all less than 10 percent; exceptions were clustered on the CC circuit associated with cathodes C187, C189, and C218. The HVR sensors for these currents were recently calibrated with no problems noted, and, it is unknown whether or not this is an indication of weakening of these CC circuits. The shutdown trip following loss of CFPC coal flow again imposed excessive voltage on the forward power take-off (PTO) current consolidation CC cabinet, which damaged the semiconductors on Slave 1.

During test 91-MATL-8, additional insight into proper adjustment of cathode iron oxide flow rates was gained. The test was started with an iron oxide slurry flow rate of 5 pounds per minute. The condition of the cathode wall steadily worsened until it had 15 intercathode voltages (ICVs) above 100 volts (V) and 2 ICVs above 125 V. At this time, the flow rate of the iron oxide slurry was increased to 6 pounds per minute because it was clear the condition of the wall would continue to worsen. It was not known at the time whether the worsening condition of the wall was due to potassium plating caused by too little iron or by iron plating caused by too much iron. An increase in iron oxide slurry was selected because the aft portion of the channel was in worse condition than the forward portion, and, typically, this is associated with too little iron oxide being added.

The results of this change were rapid and adverse. The data shows 21 ICVs over 100 V (an increase of 6) and 7 ICVs at or above 125 V (an increase of 5). This rapid deterioration led to iron oxide slurry flow being reduced to 4 pounds per minute 7 minutes after it was increased, at which time the cathode wall condition started to improve.

This experience gives further guidance on how to properly adjust iron oxide slurry flow rates based on online data. Previously, it was known that if high ICVs appeared in the front of the channel but not the back, the iron oxide flow rate should be reduced. Conversely, if the high ICVs appeared in the back but not the front, the flow rate should be increased. It was unclear what should be done when the front and back looked good but the center had the high ICVs. Based on this experience, it appears a reduction of flow rate should be done.

Test 91-MATL-7 was terminated after only 19 minutes of power due to arcing in both the test bay and control room, which was caused by a wire bundle failure.

The test series was terminated following test 91-MATL-8 when an external water leak was found on the magnet.

2.3.2 Subtask 3B -- Unassigned

2.3.3 Subtask 3C -- Data Analysis and Modeling

A series of analyses was performed to find out the possible causes of the magnet water leak problem, and three areas were considered.

The first area considered the average cooling water heat transfer coefficient. The coefficient was calculated and compared between acceptance test and recent test data. The preliminary result shows the average cooling water heat transfer coefficient has degraded approximately 30 percent over the years. A condition has developed during this period that reduces the heat movement from the magnet coils to the cooling water. Detailed flow distribution is needed to perform further detailed study.

The second area considered the temperature distribution in the copper cooling water coil. The temperature distributions in a typical copper cooling water coil under different cooling water flow rates was studied to see how much blockage of the water flow will cause unacceptable maximum copper temperature. The result indicates that unless the cooling water flow rate drops down to the laminar flow region, adequate heat transfer is achieved.

The third area considered the calculation of individual cooling water flow rate. The procedures for calculating individual cooling flow rates from outlet flow rates are under development. These procedures will provide information on possible blockage in the cooling water coil during normal operation.

Further analysis is ongoing to find out the possible cause of the magnet leak and provide procedures to prevent any flow blockage in the future. Final resolution of the problem will require that the original acceptance test be repeated to verify that actual flow rates are within the design envelope.

3.0 TECHNICAL PAPERS

Several papers are being prepared for upcoming conferences, including SEAM, IECEC, AIAA, ASME, and the Low-Rank Fuels Symposium.

4.0 PROJECTED ACTIVITIES

Facility (Task 1) activities planned for the third quarter of FY91 include:

- Completing Title I design for the iron oxide slurry system to increase system capabilities and reliability;
- Continuing design for coal system upgrades based on the recommendations of the CDIF coal system review team;
- Continuing design for seed system modifications recommended by MSE-CDIF taskforce;
- Completing installation of the TRW-supplied slag rejector equipment; and
- Completing Title I design for the ITC KC installation.

Test hardware support (Task 2) activities planned for the third quarter of FY91 include:

- Procuring selected sidebars for refurbishing existing channel sidewalls.

Test operations (Task 3) activities planned for the third quarter of FY91 include:

- initiating special projects testing;
- continuing to support MSU measurements using modified diffuser triple port walls; and
- performing a 24-hour duration test using Rosebud coal.

END

DATE FILMED

11 / 10 / 91