

Project Status Report for: March, 2000

Project Title: Ultra Low NO_x Integrated System for Coal-Fired Power Plants

Project Number: 91890460 Report Manager: John Marion

Customer Name: U.S. DOE / Performance Projects Project Leader: Charles Maney

GOALS AND OBJECTIVES:

Develop low cost, retrofit NO_x control technologies to address current and anticipated, near term emissions control legislation for existing coal fired utility boilers. Specific goals include:

- Achieve < 0.15 lb/MMBtu NO_x for eastern bituminous coals
- Achieve < 0.10 lb/MMBtu NO_x for western sub-bituminous or lignitic coals
- Achieve economics at least 25% less than SCR-only technology
- Validate NO_x control technology through large (15 MWt) pilot scale demonstration
- Evaluate the engineering feasibility and economics for representative plant cases
- Provide input to develop commercial guidelines for specified equipment
- Provide input to develop a commercialization plan for the resultant technologies

WORK PLANNED FROM PREVIOUS REPORT:

During the month of March, additional project management and developmental activities were planned with focus on firing system design and control algorithm development. Specific planned work scope included:

Project Management

- Prepare and issue subcontracts for Progress Materials, Inc. and ABB Automation, Inc., Fossil Controls Division participation in the project work.
- Identify advisory panel members / schedule first panel meeting.
- Complete detailed project planning (scope / schedule) for and formally kick-off remaining tasks including Task 4 - Bubbling Bed Char Oxidation Study, and Task 5 - Engineering Systems Analysis and Economics.

Integrated System Development

- Initiate design of firing system hardware for large pilot scale (BSF) testing
- Finalize Global Mixing Process task work plan and run baseline TFS 2000™ CFD simulation of BSF
- Initiate development of the neural network control model, and engineering of flame scanners and coal flow sensors for the BSF testing
- Assess current condition of the BSF and begin facility preparations

ACCOMPLISHMENTS FOR REPORTING PERIOD:

The following project work was accomplished during the month of March:

Project Management

Prepare and issue subcontracts for Progress Materials, Inc. and ABB Automation, Inc., Fossil Controls Division participation in the project work.

- Term sheets covering the scope of the work to be subcontracted to Progress Materials, Inc. and ABB Automation, Inc., Fossil Controls Division were prepared and delivered in March. Final negotiations with each subcontractor over the contained terms are expected to occur in April.

Identify advisory panel members / schedule first panel meeting.

- An invitation to participate on the project Advisory Panel was accepted by three U.S. utilities in March. **Accepting panel** members include PacifiCorp, Sithe Energy, and Indianapolis Power & Light. The first panel meeting has been tentatively scheduled for mid- to late May at ABB Alstom Power, Windsor, CT.

Complete detailed **project planning** (scope / schedule) for and formally kick-off remaining tasks including Task 4 -Bubbling Bed Char Oxidation Study, and Task 5 - Engineering Systems Analysis and Economics.

- A detailed Milestone and Deliverables Schedule was completed, in fulfillment of overall project planning task requirements. A final copy of this list is provided at the end of this report.
- Two additional project tasks, Task 4 -Bubbling Bed Char Oxidation Study, and Task 5 - Engineering Systems Analysis and Economics work were formally kicked-off in March. Work on these tasks will begin in April pursuant to the project plan.

In addition, a Hazardous Substance Plan was issued as required by Section 4.3, Attachment B of the contract, Federal Assistance Reporting Checklist.

Finally, AAP agreed to a reduction in the U.S. DOE fiscal year 2000 budget commitment (re. **October 1, 1999 through September 30, 2000**) from \$1,300 KUSD to \$1,200 KUSD as this modification **will not** affect planned fiscal year 2000 activities. The overall U.S. DOE program budget remains at \$1,945 KUSD, with the balance (\$745 KUSD) to be provided by U.S. DOE during fiscal year 2001.

Integrated System Development

Initiate design of firing system hardware for large pilot scale (BSF) testing

- Existing BSF firing system components were removed and inspected for wear in preparation for rebuilding and / or replacing them as part of the subject work. The majority of the main burner components (coal auxiliary air nozzles) are suitable for reuse, pending final determination of the hardware requirements for the test program. However the overfire air compartments exhibit significant wear due to over heating and will thus require a complete rebuild in order to be used.

Finalize Global Mixing Process task work plan and run baseline TFS 2000™CFD simulation of BSF

- A CFD model of the BSF configured with the TFS 2000™ firing system was set-up, and execution of it begun during the month of March. Pending final convergence, this model will be used for evaluation of advanced OFA systems designed for improved mixing / reduced costs as part of an ultra-low NOx integrated system design.

Initiate development of the neural network control model and engineering of flame scanners and coal flow

- Pre-test, multi-variable analysis and preliminary neural net modeling activities for the advanced control system were begun in March. BSF combustion test data from the 1995/6 U.S. DOE LEBS program has been retrieved and will be used to set-up and evaluate preliminary control system designs.
- In addition, the Fuzzy logic toolbox for MatLab was procured, and neuro-fuzzy controller configuration activities were begun for use in controlling the coal and air flow balancing loop associated with the commercial design system.

Assess current condition of the BSF and begin facility preparations

- Inspection / clean up of the windbox and refractory inside the BSF was begun in March. Loose ash and slag was removed from the facility walls and evacuated from the BSF hopper bottom.
- A preliminary hydro / water pressure test of the BSF water jacket was performed in March. Initial testing has surfaced two (2) leaks in the water jacket and one (1) in the simulated economizer section tubing. Repairs to these sections will be effected in early April, and a follow on hydro test performed.
- Inspection of the pressure relief waterbeds surfaced significant oxidation of the support enclosures. Required material purchases were made in March and repair will be effected in early April.

WORK PLANNED FOR NEXT REPORTING PERIOD:

During the month of April, additional developmental and project management activities will occur, focusing on test facility preparation, firing system design (burners and OFA / modeling), and control system & algorithm development. Specific planned task work for April includes:

Task 2.1 – Test Fuels Characterization

- Select test fuels / obtain samples for bench scale analyses

Task 2.2 – Low NO_x Pyrolysis Burners

- Complete engineering design of Low NO_x Pyrolysis Burners for large pilot scale testing

Task 2.3 – Global Mixing Process Improvement

- Converge baseline case with particle radiation coupling to match measured furnace outlet temperature. Compare predictions with experimental measurements. Initiate execution of additional cases to investigate the impact of Separated Overfire Air (SOFA) velocity and location.

Task 2.4 – Advanced Control System Design

- Order coal flow meters and initiate Carbon in Ash sensor material procurement.
- Complete pre-test multi-variable analysis and preliminary neural net modeling activities based on the historical BSF data.
- Begin MatLab / Simulink air and fuel flow balancing controller modeling.

- Complete repairs to BSF water jacket and waterbed enclosures.
- Inspect / clean scale from the inside of the BSF hopper bottom.
- Perform a detailed evaluation of the status of all, required BSF Instrumentation and Control (I&C) systems and prepare an I&C project planning worksheet.

Additional, related activities include completion of a plan to upgrade / replace the existing BSF DCS control system, and initiation of the related capital appropriation request.

Task 4 – Carbon Burnout System Evaluation

- Execute subcontract agreement with Progress Materials
- Select field unit for CBO™ system evaluation study.

Task 5 – Engineering Systems Analysis & Economics

- Initiate review of preliminary (proposal) economic evaluation of currently identified components to the Ultra-low NOx Integrated System.

Task 6 – Advisory Panel

- Schedule / confirm date for first Advisory Panel meeting.