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Scaling of Pressurized Fluidized Beds

**Quarterly Report
January - March 1994**

**Leon R. Glicksman
Paul A. Farrell**

March 1994

Work Performed Under Contract No.: DE-FC21-92MC29264

**For
U.S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia**

**By
Massachusetts Institute of Technology
Cambridge, Massachusetts**

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P.O. Box 880
Morgantown, West Virginia 26507-0880**

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77 Massachusetts Avenue, 4-209 MIT
Cambridge, Massachusetts 02139**

March 1994

MASTER

Overview

This report provides a summary of the technical progress made during the second quarter of the second budget period on Cooperative Agreement No. DE-FC21-92MC29264, "Scaling of Pressurized Fluidized Beds."

Technical Progress Report

- Cold Scaled Model of Tidd Plant

Construction and installation of the quarter-scale cold model of the Tidd pressurized bubbling bed combustor is complete. The cyclone and filter box have been installed, and the bed is fully instrumented. A data acquisition system has been set up to obtain time-varying pressure measurements from the cold model. Additional software to reduce orifice plate pressure drop measurements into flows was completed. The capability to calculate the power spectral density (PSD) and probability density function (PDF) for the pressure fluctuation data has also been established.

The last major work item remaining before data can be obtained from the model is to segregate the cold bed particles to obtain the required mean particle diameter and size distribution. As mentioned in the last quarterly report, a linear low-density polyethylene produced by Union Carbide was chosen as the cold bed material. Union Carbide distributes the granular polyethylene in 1200 lb_m boxes. The large volume of particles makes the use of standard laboratory sieving methods impractical. We are currently attempting to segregate the particles by fluidizing them in the cold model. Different size particles will be carried out of the bed at different superficial velocities depending on their terminal velocities. The elutriated particles can then be collected using the cyclone separator.

- Testing at Tidd

Initial pressure fluctuation data were obtained from the Tidd plant on 24 February 1994. The data were taken at a single bed-height and pressure-level. Plots of the power spectral density and the probability density function of the data at different locations in the bed are included in **Appendix A**. Future testing recommendations will be based on the initial scaling comparisons between this data and data from the cold model.

• American Electric Power (AEP) Interest in Project

On 11 March 1994, individuals from MIT (L. Glicksman and P. Farrell) and Babcock and Wilcox (T. Fuller) discussed the objectives of the current project with American Electric Power (D. Bauer and M. Marroco) in a conference call. The individuals from AEP described some of the hydrodynamic issues they had encountered while operating Tidd, particularly those associated with the fuel feed geometry. They are interested in the current project because of its potential to examine some of the hydrodynamic issues associated with the Tidd Plant. AEP offered cooperation to help us obtain the data we require from Tidd. They also would like to visit MIT to discuss the project further and to see the cold scale model when it is fully operational.

Emphasis of Work During Next Quarter

Efforts during the third quarter of the second budget period will focus on:

- obtaining the required particle size and size distribution for the cold model bed material, and
- making scaling comparisons between the dynamic characteristics of the cold model and the Tidd pressurized bubbling fluidized bed combustor.

Appendix A

DATE

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7/18/94

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