

**Fundamental Study of Black Liquor Gasification Kinetics**  
**Using a Pressurized Entrained-Flow Reactor (PEFR)**

**Quarterly Progress Report for the Period**  
**July 1999 to September 1999**

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The goal of this program is to identify the optimal operating window for black liquor gasification. During this fiscal year, work has focused exclusively on Task 1, Preparation for Combined PEFR/TMBMS Operation. The goals of this task are to prepare the PEFR for operation, conduct a series of preliminary screening tests to bracket BLG operating conditions, and develop a process model that can guide identification of the optimal operating window.

Progress on the experimental phase of this project has been delayed because the pressurized entrained flow reactor at IPST was not operational by the projected start date. The unit has been tested in cold-flow and hot-flow, unpressurized operation. As of June 30, the equipment had been completely installed and start-up was under way, but some problems with the computer control system remained. Due to the large amount of effort relocating the PEFR and manpower constraints for completing its construction, the project is currently about five months behind schedule.

On July 28, the first run with black liquor at pressurized conditions (2.5 bar, 800°C) was completed. The unit is now fully operational, and IPST is taking data to check the carbon mass balance and reproducibility of gas composition. We expect to have the majority of the work in Task 1 completed by the end of calendar 1999. Currently, IPST is making dry runs (with no particle feed) to check out the control system and gasifier stability. Following this, they will make runs with black liquor to check the carbon balance. We will then complete the matrix of tests for screening the gasification operating window. IPST has dedicated the reactor to this project through 12/99 or until completion of the process variable tests. We anticipate being ready for the NREL MBMS no later than January 1, 2000.

In support of operations, Air Products assisted IPST in conducting a HAZOP evaluation of the unit. Potential hazards include operation with pressurized gas, flammable/toxic properties of some gas constituents, and operation with oxygen. We discussed several operating procedures and potential safety interlocks to ensure safe operation.

APCI has completed an initial process model for the black liquor gasification process using the OLI software. We have emphasized the fate of trace species in the quench section of the gasifier. The calculations confirm the importance of quantifying the kinetics of heavy tar formation, particularly naphthalene and other multi-ring species. APCI presented some preliminary conclusions of the modeling work at the AF & PA meeting in July.

During this period, APCI and IPST concluded negotiations of the subcontract including rights to intellectual property arising from joint developments under the project.