Project Summary

1) TITLE: DE-FC26-98FT40321-71
Pilot-Scale Testing of Potential Mercury Control Technologies for TXU

2) PROJECT PARTICIPANTS: TXU and DOE NETL

3) PROJECT DESCRIPTION:

A. Objective(s)
This project is intended to identify and evaluate potential mercury control technologies at the pilot scale that show promise for application at plants burning Gulf Coast lignite, or a blend with subbituminous coal. Gulf Coast lignite is one of the most challenging coals in regard to mercury control because of its high mercury concentration and the high percentage of elemental mercury.

B. Background/Relevancy
Of all the mercury control options available to be deployed to meet pending mercury control regulations, ACI is considered to be among the most mature and, therefore, most readily available for commercial use in coal-fired power plants. However, very small amounts of carbon (generally considered to be <1% by volume) will render the fly ash unacceptable for commercial sale. One solution to this dilemma is to use a TOXECON™ system whereby AC is injected after an electrostatic precipitator (ESP), but prior to a fabric filter (FF), leaving the majority of the fly ash available for sale or further use. TXU's Big Brown Station burns a Gulf Coast lignite– subbituminous blend and is equipped with a TOXECON™ configuration. Analysis of this Gulf Coast lignite blend shows a particularly high ratio of elemental mercury, providing a good test condition for evaluating ACI, as well as other possible control technologies

Other options have also been shown by previous research to improve removal of mercury. For example, lowering the combustion temperature will often improve AC capacity. In addition, many forms of coal pretreatment have been found to have varying effects on mercury removal. Great River Energy (GRE) is developing a thermal treatment that has shown some success on North Dakota lignite to provide some mercury removal. The effectiveness of these approaches as well as new technologies need to be tested because of the unique challenges that Gulf Coast lignite presents

C. Period of Performance: 1/1/2004–5/31/2005

D. Project Summary
Using the EERC's 550,000 Btu pilot-scale combustor configured with an ESP and a FF, tests were conducted to evaluate ACI when combusting a Gulf Coast lignite–subbituminous coal blend. Total mercury and speciation data were collected using continuous mercury monitors and the Ontario Hydro method. The tests were done on a 70% Texas lignite–30% Powder River Basin blend that was representative of that burned at TXU's Big Brown Station. TXU faces challenges for mercury control at its Big Brown Station. Gulf Coast lignite contains a relatively high mercury content as compared to other U.S. coals—approximately 0.2 ppm of mercury. Also, analysis of TXU's lignite indicates that approximately 80% is elemental mercury and 20% is oxidized.

Several mercury control options (as shown below) were identified and tested for their ability to remove mercury.

- Standard ACI
- Treated ACI
- Standard ACI plus additives
- Lower flue gas temperatures
- Coal pretreatment using the GRE process.

4) PROJECT COSTS:

A. DOE Costs - $151,262

B. Recipient Share * $280,756

C. Project Total * $432,018

5) MAJOR ACCOMPLISHMENTS SINCE THE BEGINNING OF THE PROJECT:

Several AC, AC plus additive combinations, and treated AC were tested at varied injection rates. Despite challenges, short-term, pilot-scale tests indicated that mercury removal efficiencies ranged from 15% to 90%, depending upon operational parameters and whether AC was used alone, in combination with additives, or treated—all at ACI rates <10 lb/Macf. For these pilot-scale results, 30%–50% mercury removal was achieved using standard ACI alone. The most promising sorbent technology for these tests was a combination of standard ACI and an additive combination that were used with lowered combustion temperatures. Limited, short-term data were obtained showing close to 90% mercury removal at the pilot-scale at injection rates <6 lb/Macf. This parametric change would require a sizeable expenditure for TXU and further testing is needed to prove the viability of this option at a larger scale over a longer duration.

This testing also demonstrated the significance of flue gas temperature on AC performance. Pilot-scale tests show that lowering the temperature by only 35°F can increase the effectiveness of standard and treated AC. Conversely, increasing the combustion temperature by 50°F resulted in less mercury capture compared to a typical operating temperature of 350°F.

Based on these pilot-scale test results, several options were identified that show promise for ≥50% mercury removal while burning a Gulf Coast lignite–subbituminous coal blend. These options require larger-scale, longer-term tests, which are planned under Round II of DOE's Phase II Mercury Field Testing Program.

6) MAJOR ACCOMPLISHMENT PLANNED DURING THE NEXT 6 MONTHS:

The draft final report is being written for this project and will be submitted to TXU and DOE. The project is expected to be complete by May 31, 2005.

7) ISSUES:

The coals that were tested had a high selenium content, making measurement somewhat difficult. While there are special measures that can be taken to minimize selenium-related effects, these effects may not necessarily be eliminated under all test conditions. Thus, some of the observed data scatter may be attributed to measurement difficulty.