PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

**Environmental & Water Resources**

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# PILOT-SCALE TESTING OF POTENTIAL MERCURY CONTROL TECHNOLOGIES FOR TXU

## CONTACTS


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## PARTNERS

**Energy & Environmental Research Center**
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**Texas Utilities Companies (TXU)**
Fairfield, TX

## Description

### Objective

This project is intended to identify and evaluate potential mercury control technologies at the pilot scale which 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.

### Background

Of all the mercury control options available to be deployed to meet pending mercury control regulations, activated carbon injection (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 activated carbon (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. The Texas Utilities Companies (TXU) 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. A thermal treatment 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.

## 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 the TXU Big Brown Station. TXU faces challenges to control mercury at its Big Brown Station because 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 lignite indicates that approximately

## COST

**Total Project Value**
$432,018

**DOE/Non-DOE Share**
$151,262 / $280,756

## PERIOD OF PERFORMANCE

January 2004 to
May 2008

## ADDRESS

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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

## Accomplishments

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 that was 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 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 $\geq$ 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.

## Planned Activities

The draft final report is being written for this project and will be submitted to TXU and DOE.

## 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 data variability may be attributed to measurement difficulty.