PROJECT facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Environmental and Water Resources

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Field Testing of Activated Carbon Injection Options for Mercury Control at TXU's Big Brown Station

CONTACTS

Thomas J. Feeley III
Technology Manager
Environmental & Water Resources
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-6134
thomas.feeley@netl.doe.gov

Sara M. Pletcher
Project Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4236
sara.pletcher@netl.doe.gov

John Pavlish
Principal Investigator
University of North Dakota
P.O. Box 9018
Grand Forks, ND 58202
701-777-5000
jpavlish@undeerc.org

Background

The 2005 Clean Air Mercury Rule will require significant reductions in mercury emissions from coal-fired power plants. Lignite coal is unique because of its highly variable ash content (rich in alkali and alkaline-earth elements), high moisture levels, low chlorine content, and high calcium content. Unique to Texas lignite coals are relatively high iron and selenium concentrations. When combusting Texas lignite coals, up to 80 percent of the mercury in the flue gas is present as elemental mercury, which is not readily captured by downstream pollution control devices.

To better understand the factors that influence mercury control at units firing Texas lignite or a lignite and subbituminous coal blend, the University of North Dakota Energy and Environmental Research Center (UNDEERC) is field testing several activated carbon injection (ACI) options. These technologies include conventional (i.e., untreated) ACI, chemically-treated ACI, and ACI coupled with sorbent enhancement additives (SEA). Chemically-treated ACI and SEA introduce excess halogens into the combustion flue gas, which may lead to increased oxidized mercury concentrations and improved ACI performance.

TXU Power's Big Brown Station

PARTNER

University of North Dakota
Energy and Environmental
Research Center

PERIOD OF PERFORMANCE

03/02/2005 to 03/01/2008

COST

Total Project Value
$2,092,197

DOE/Non-DOE Share
$1,500,000 / $592,197

ADDRESS

National Energy Technology Laboratory
1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

2175 University Avenue South
Suite 201
Fairbanks, AK 99709
907-452-2559

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

One West Third Street, Suite 1400
Tulsa, OK 74103-3519
918-699-2000

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

Primary Project Goal

This project will evaluate the long-term feasibility of ACI to reduce mercury emissions by at least 55 percent at Texas electric generation plants that burn a blend of Texas lignite and Powder River Basin (PRB) subbituminous coals. TXU Power's Big Brown Station Unit 2 near Fairfield, Texas will serve as the host site for full-scale field testing. The 600 MW unit is equipped with an electrostatic precipitator (ESP) and downstream fabric filter (FF). When these control technologies are coupled with ACI, the overall system is referred to as the toxic emissions control (TOXECON™) configuration.

Objectives

- Demonstrate mercury removal of at least 55 percent from power plants burning a lignite/subbituminous coal blend.
- Conduct short-term parametric tests using NORIT Americas' conventional DARCO® Hg sorbent, DARCO® Hg injection enhanced with an UNDEERC proprietary SEA, and a proprietary chemically-treated sorbent developed by UNDEERC. These tests are intended to: (1) gain a better understanding of the plant-specific factors that influence mercury capture; (2) determine the best PAC and/or SEA for long-term testing; and (3) establish the optimal operating conditions for the long-term continuous ACI test.
- Conduct a one-month ACI trial to evaluate mercury removal efficiency over time and examine the impact of ACI concentration on FF pressure drop.
- Perform a preliminary economic analysis to assess the cost of mercury control via ACI.

Accomplishments

The parametric testing campaign has been completed across the TOXECON™ configuration at Big Brown Unit 2. Based on the results of parametric testing, UNDEERC's proprietary chemically-treated sorbent was selected for the long-term continuous demonstration. During long-term testing, Big Brown Unit 2 fired a coal blend consisting of 70 percent TX lignite and 30 percent PRB subbituminous. Average total mercury removal was approximately 70 percent during continuous ACI at an average sorbent injection concentration of 1.5 lb/MMacf.

During full-scale ACI testing, the project team observed increased residual drag buildup on the FF bags, resulting in a noticeable increase in baghouse pressure drop. UNDEERC is exploring the root cause for this phenomenon.

Planned Activities

- Continued analysis of sorbent performance and the impact of ACI on FF operation and fly ash properties.
- Initiate economic analysis using data collected during the long-term TOXECON™ mercury control trial.