FY04-L(50)-124

"Enhancing Carbon Reactivity in Mercury Control in Lignite-Fired Systems"

CONTRACTOR: Energy & Environmental Research Center
PRINCIPAL INVESTIGATOR: Michael J. Holmes

PARTICIPANTS

Sponsor	Cost Share
Basin Electric Power Cooperative	$146,109
Great River Energy	$ 68,520
Minnkota Power Cooperative	$ 5,337
Ottertail Power Cooperative	$ 3,982
Montana Dakota Utilities	$ 2,532
SaskPower	$153,850
Falkirk Mine	$ 4,440
Westmoreland	$ 4,440
BNI	$ 4,440
Coteau Mine	$ 4,440
ADA-ES	$282,500
B&W	$111,794
URS	$ 45,849
NDIC	$600,000
DOE	$4,155,462
Total Cost	$5,732,195

Project Schedule - 36 Months

Contract Date – 2/15/04
Start Date – 2/15/04
Completion Date – ~~9/30/06~~
Extended to – ~~12/31/06~~
– ~~9/30/07~~
– ~~3/31/08~~
- 6/30/08

Project Deliverables

Contract signed: ✓
Quarterly Reports: 12/31/03 (✓)
3/31/04(✓); 6/30/04(✓); 9/30/04(✓);
12/31/04(✓); 3/31/05(✓); 6/30/05(✓);
9/30/05(✓); 12/31/05(✓);
3/31/06(✓); 6/30/06(✓)
Final Report: ~~12/31/06( )~~
~~9/30/07 ( )~~
~~3/31/08 ( )~~
6/30/08 (✓)

OBJECTIVE / STATEMENT OF WORK

Substantially enhance the capability of carbon sorbents to remove Hg from lignite flue gases to achieve a high level of cost-effective control. The enhancement processes have been proven at the pilot scale and in limited full-scale tests. The work proposed here focuses on full-scale testing at four lignite-fired units: Leland Olds Station Unit 1 (ESP), Stanton Station Units 1 (ESP) and 10 (spray dryer-baghouse), and Antelope Valley Station Unit 1 (spray dryer-baghouse).

FINAL REPORT SUMMARY

Purpose of the Project: The Energy & Environmental Research Center (EERC) conducted a consortium-based effort to resolve mercury (Hg) control issues facing the lignite industry under the

U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Phase II Round I sponsored program. The EERC team, which included the Electric Power Research Institute; the URS Corporation; the Babcock & Wilcox Company; ADA-ES; Apogee; Basin Electric Power Cooperative; Otter Tail Power Company; Great River Energy; Texas Utilities; Montana-Dakota Utilities Co.; Minnkota Power Cooperative, Inc.; SaskPower; BNI Coal Ltd.; Dakota Westmoreland Corporation; the North American Coal Corporation; and the North Dakota Industrial Commission, demonstrated technology to substantially enhance the capability of carbon sorbents to remove Hg from lignite combustion gases. The results of this effort are applicable to virtually all utilities burning lignite and subbituminous coals in the United States and Canada. The enhancement processes selected were first proven in pilot scale and demonstrated in short-term, full-scale tests. The four units in North Dakota selected for extended testing included three lignite-fired units: Leland Olds Station Unit 1 (LOS1) and Stanton Station Unit 10 (SS10) near Stanton and Antelope Valley Station Unit 1 (AVS1) near Beulah, and a subbituminous Powder River Basin (PRB)-fired unit, Stanton Station Unit 1 (SS1).

This project is one of three conducted by the consortium as part of the DOE NETL Phase II Round 1 mercury program to systematically test Hg control technologies available for utilities burning lignite. The overall objective of the three projects was to field-test and verify options that may be applied cost-effectively by the lignite industry to reduce Hg emissions. In this project, the EERC, URS, and other team members tested sorbent injection technologies for plants equipped with electrostatic precipitators (ESPs) and spray dryer absorbers combined with fabric filters (SDAs-FFs).

Carbon injection technologies have been shown to be the most viable commercial options for systems without wet sulfur dioxide scrubbers, including those emitting primarily elemental mercury (Hg^o). Lignites, because of their low chlorine and high calcium contents, liberate mainly Hg^o during combustion, and their fly ashes possess low Hg-sorbent reactivity. Two technologies have been identified that overcome these problems by using additives to enhance mercury capture or treated carbons to increase sorbent reactivity and Hg capture. Both technologies were successfully demonstrated in pilot-scale and short-term field tests first and then were tested during a month-long period on units configured with an ESP or SDA-FF combination.

Work accomplished: Parametric and month-long tests were conducted at LOS1, SS10, AVS1 and SS1 to determine the mercury removal effectiveness of various sorbents and additives. Cost analyses were also performed to determine the cost impact of the plants incorporating the technologies at their sites.