ENHANCING CARBON REACTIVITY FOR MERCURY CONTROL IN COAL-FIRED POWER PLANTS: RESULTS FROM LEWIS AND CLARK AND STANTON STATIONS

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ABSTRACT

This project was awarded under U.S. Department of Energy National Energy Technology Laboratory Program Solicitation DE-PS26-03NT41718-01. The Energy & Environmental Research Center (EERC) is leading a consortium-based effort to resolve mercury (Hg) control issues facing the lignite industry. The EERC team—the Electric Power Research Institute (EPRI); 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.; BNI Coal Ltd.; Dakota Westmoreland Corporation; the North American Coal Corporation; SaskPower; and the North Dakota Industrial Commission—seeks to substantially enhance the capability of carbon sorbents to remove Hg from lignite combustion gases to achieve a high level of cost-effective control. The results of this effort will be applicable to virtually all utilities burning lignite in the United States and Canada and will also apply to subbituminous coals. The enhancement processes were previously proven in pilot-scale and limited full-scale tests. Additional optimization testing continues on these enhancements. This project focuses on full-scale testing at three lignite-fired units in North Dakota and one in Montana: Leland Olds Station Unit 1 and Stanton Station Unit 10 near Stanton North Dakota; Antelope Valley Station Unit 1 near Beulah, North Dakota; Lewis & Clark Station (L&CS) near Sydney, Montana; and at one subbituminous coal-fired unit, Stanton Station Unit 1 (SS1), near Stanton, North Dakota.

The lignite industry has been proactive in advancing the understanding of control mechanisms and the identification of control options for Hg in lignite combustion flue gases. Over 4 years ago, the EERC and EPRI initiated discussions on Hg control with utilities and coal companies working with Fort Union (North Dakota and Saskatchewan) and Texas Basin lignites, representing most of the lignites used in North America. This project is a cooperative effort of these industry partners to address the specific needs and challenges to be met in controlling Hg from subbituminous coal- and lignite-fired power plants.

Work was completed at L&CS. The full-scale unit with a 60-MW, T-fired boiler cyclone for particulate control followed by wet flue gas desulphurization (WFGD). The best combination of sorbents was found to be SEA2 with activated carbon. During the injection, it was noted that particulate-bound Hg exiting the stack increased because of the fine powdered activated carbon (PAC) particles not being captured by the WFGD. Because continuous mercury monitors (CMMs) only measure gas-phase Hg, the Hg removal rates calculated based on the CMM results

are biased high during the injection of these technologies. Therefore, Hg removals greater than 75% were not obtained in the full-scale system when Ontario Hydro method results, including particulate-phase Hg, were used in the calculations. The results of full-scale and slipstream baghouse (SSBH) testing would suggest that in order to achieve >75% Hg removal, an additional particulate control device would be necessary to capture the fine PAC that is not being captured in the existing WFGD. The SSBH results indicate good capture of particulates entering the baghouse, and it appeared that no fine particles were passing through the fabric filter. SSBH results indicated better performance in terms of Hg control efficiency with lower rates than the full-scale unit.

Work at SS began in August with the start of a 60-day continuous activated carbon injection (ACI) test on Unit 1. SS1 is configured with an electrostatic precipitator (ESP) for particulate control. The objective of the extended test is to evaluate performance variability of the ACI process as well as any balance-of-plant impact associated with ESP operation or combustion by-product properties. Early results will be discussed.