EERC Response to North Dakota Industrial Commission's
TECHNICAL REVIEWERS' COMMENTS

LRC-LXXI(71)-B: "Water Recovery from Lignite Drying"

The goal of the Energy & Environmental Research Center (EERC) proposed project is to demonstrate that water produced during the drying of North Dakota lignite can be economically recovered and to develop baseline data that will provide new marketing strategies for North Dakota lignite. The project will utilize a heat exchange technology developed by SPX Cooling Technologies to condense moisture from a slipstream of the exhaust from one of the Lignite Fuel Enhancement (LFE) dryers at Great River Energy's (GRE's) Coal Creek Station. Reviewer comment topics are in bold, and responses follow.

Project Communications

The EERC will be responsible for overall project management and coordination of project activities. Once the project is initiated, monthly or as-needed conference calls will be held with project sponsors and team members to review the project status. GRE, with EERC input, will oversee the installation of the test system at Coal Creek Station. The EERC project manager will be responsible for routine communication among the respective project participants and for ensuring that the project is conducted in a timely manner and within budget.

In addition to routine communication between the EERC, GRE, and Westcon, Inc., the installers of the test system, SPX, the North Dakota Industrial Commission (NDIC) Lignite Research Council (LRC), the Electric Power Research Institute (EPRI), and the U.S. Department of Energy (DOE) (refer to Figure 1 for the communication chart), the project manager will be responsible for the preparation and submission of all required project reports, including the semiannual technical project report to NDIC and a final technical project report to all participants. If NDIC requests, the EERC will present at the Lignite Technology Development Working Group.

The Scale of This Project Relative to That Already Demonstrated for Cooling Tower Applications and Sizing of the Equipment

The proposed project is a significantly different application of SPX's Air2Air technology compared to cooling towers. SPX developed new modules designed for higher flow to increase heat transfer and made of a proprietary material that will be capable of withstanding the higher temperatures (as high as 120° to 125°F) associated with the lignite dryer application, as well as differing water chemistry and associated issues related to scaling and fouling. The test system, to be located on the 16th floor of Coal Creek Station, is a single standard-size SPX module with dimensions of 5.3' × 5.3' × 12' and weighing 1200 lb, connected via ductwork to a slipstream of the LFE exhaust.

The Air2Air heat exchanger will be placed within a housing designed by SPX, with GRE and EERC input, so that the wet LFE exhaust flow is vertical and ambient cooling airflow is horizontal through the heat exchanger. The test system will employ two fans, one to supply approximately 15,000 cfm for cooling the LFE exhaust and one to overcome the 0.705 inches of

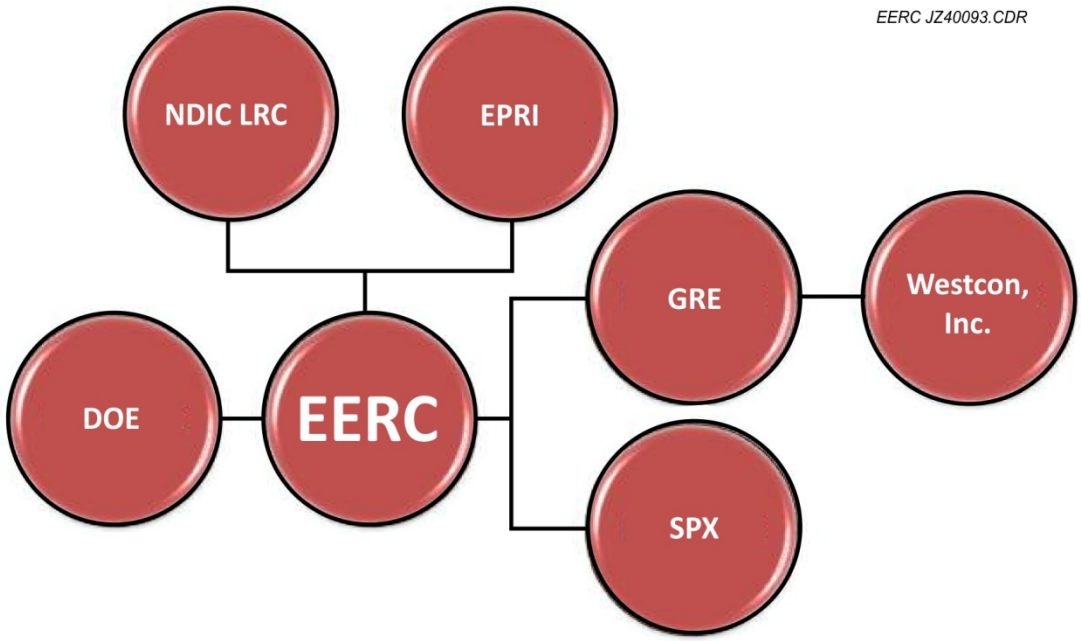

Figure 1. Communication chart.

water pressure drop for the heat exchanger to return the slipstream of dried LFE exhaust back into the LFE stack ductwork. An average of approximately 2000 gallons a day of condensed water will be collected during the demonstration project and plumbed to a GRE-desired location. Estimated flows of various process streams are illustrated in Figure 2.

Amount of Water Recovered Relative to Power Plant Needs

The lower-moisture coal from GRE's LFE system has the potential to be comparable in heating value to bituminous, allowing lignite to be marketed to a wider customer base because of its significantly lower cost ($14/ton lignite vs. $32/ton for bituminous); the opportunity for water savings adds to the value and expands the marketability of GRE's system and thus North Dakota lignite. The proposal authors recognize that the recovered water will only satisfy a relatively small percentage of power plant cooling water needs. The project is aimed at determining the amount of water that could be recovered and the quality of that water relative to different operating conditions and ambient temperatures. The amount of water recovery would determine the relative percentage of water available to supplement any existing supply, which can be critically important in arid areas or in drought conditions. The recovered water would ideally be stored (covered ponds or aquifer storage) and used at times when existing supplies would not be adequate to address cooling needs and would result in derating.

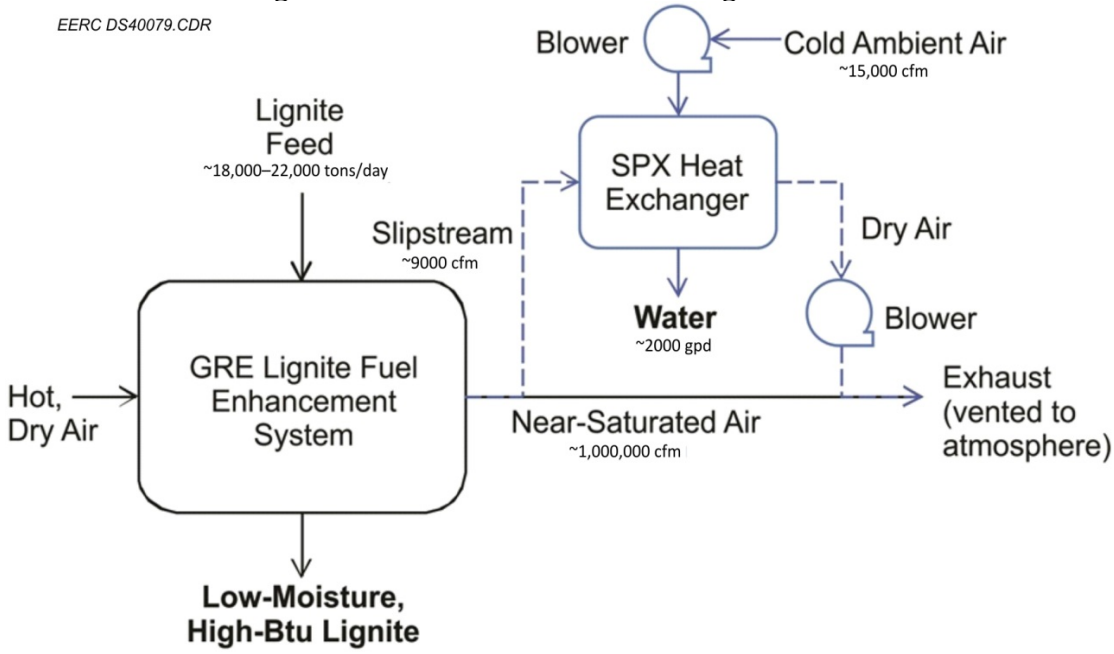

Figure 2. Proposed slipstream test system at Coal Creek Station.

SPX Air2Air Technology Awareness

SPX Cooling Technologies is a partner in the proposed project. It has already dedicated significant effort to the design and fabrication of a modified heat exchange module specific to the lignite-drying application.

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Water Recovery Relative to the Needs of Hydraulic Fracturing

The demand for freshwater for hydraulic fracturing in the Bakken oil play in western North Dakota is growing significantly, and that demand will increase as oil companies continue to drill additional wells and incorporate more fracture stages for each well. The access to freshwater is limited, and freshwater is transported by tanker truck at significant expense. Relatively close access to a reliable supply of freshwater would be a significant benefit to an industry that currently pays as much as $25/1000 gallons, not including transportation. Recovery of the estimated 30% of the moisture removed from 20,000 tpd of lignite would produce the equivalent of 73,000,000 gallons of water annually, the equivalent value of $1.8 million. The estimated cost of just the SPX heat exchangers to recover that water from Coal Creek Station would be around $450,000 plus installation.

Data and Information Collected

Data downloads of temperature, flow, and conductivity will be performed remotely for a period of 1 year. Condensed water samples will be collected, preserved accordingly, and submitted to a certified commercial laboratory for analyses to provide data for a detailed chemical characterization. Samples will be collected during steady-state operation during periods of extreme hot and cold operation as well as average annual temperature conditions. We envision up to six separate sampling events to assess water quality. Each sample will consist of a composite of several grab samples collected at regular predetermined intervals.

Additional comments will be addressed at a presentation at the meeting of the Lignite Research Council on May 17, 2011, in Bismarck, North Dakota.

Project Budget

Table 1. Project Budget

	Project
Labor, hr	5866
Travel, trips	12
Equipment	$11,349
Installation (Westcon, Inc.)	$93,651
Supplies/Analyses	$32,845
Total	$897,335

The labor hours total 5866 for six to eight engineers/scientists, equating to an average of 20% work time spent for each EERC person, to design, construct, test, and evaluate the proposed pilot system as well as report and conduct a market assessment over the 18-month period of performance. A total of 12 trips are anticipated for EERC personnel to travel to the GRE site to install and monitor the system, perform sampling, and participate in project meetings and presentations. An estimated equipment cost of $11,349 is for system blowers and ductwork. The cost of installing the heat exchangers on the 16th floor at Coal Creek Station is $93,651. $32,845 is estimated for supplies, installation and operation of the proposed system, and for analyses of collected water samples during testing. Thus a total of $897,335 is requested for project completion.