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May 22, 2000

Ms. Karlene Fine, Executive Director  
North Dakota Industrial Commission  
600 East Boulevard Avenue  
Bismarck, ND 58505

Subject: Grant Application for a Mercury Control Options Evaluation  
Coal Creek Station & Stanton Station

Dear Ms. Fine:

Enclosed is a Grant Application requesting North Dakota Industrial Commission (NDIC) co-funding of a study to evaluate mercury control options at Great River Energy's two North Dakota power plants. Great River Energy (GRE) is requesting matching funds of \$95,000 from NDIC's Lignite Research, Development and Marketing Program. A \$100 check is also enclosed to cover the application fee.

The project for which we are requesting funding is a slipstream study of potential mercury emission reduction options at GRE's Coal Creek Station and Stanton Station; both plants fire 100 percent North Dakota lignite coal. The goal of the project is to determine if cost-effective means are available to reduce mercury emissions from lignite-fired utilities.

The study will also test the feasibility of producing activated carbon from lignite. The activated carbon would then be tested to determine its mercury removal efficiency. Results from the testing will be compared with those for other sorbent materials.

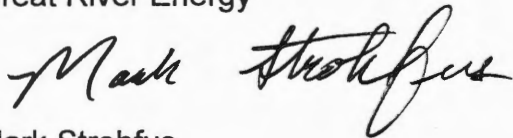
This study will generate data that could prove useful in developing cost-effective, competitive options for reducing mercury emissions from lignite-fired utilities. The data could also prove useful in the development of air toxic control standards if EPA were to determine in December 2000 that regulations are appropriate. Such data could include the feasibility of specific control options for control mercury emissions from lignite-fired utilities and the economics of specific control options.

Ms. Karlene Fine  
May 22, 2000  
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If you have any questions regarding the enclosed Grant Application or the proposed project, please call me at 612-241-2491.

Sincerely,

Great River Energy

A handwritten signature in black ink that reads "Mark Strohfus". The signature is written in a cursive style with a large, looped "M" and "S".

Mark Strohfus  
Environmental Policy Analyst

Enclosure: Grant Application (35 copies)  
\$100, Check No. 1046, Petty Cash Account

c: Dr. Ramsay Chang, EPRI

# **GRANT APPLICATION**

For a

## **MERCURY CONTROL OPTIONS EVALUATION**

At

### **COAL CREEK STATION, UNDERWOOD, NORTH DAKOTA & STANTON STATION, STANTON, NORTH DAKOTA**

***Presented to:***

Ms. Karlene Fine, Executive Director  
North Dakota Industrial Commission  
600 East Boulevard Avenue  
Bismarck, ND 58505

***Submitted by:***

Great River Energy  
17845 East Highway 10  
PO Box 800  
Elk River, MN 55330-0800

***Principal Investigator:***

Dr. Ramsay Chang  
Electric Power Research Institute  
3412 Hillview Avenue  
Palo Alto, CA 94304-1395

**May 19, 2000**

**Funds Requested from the North Dakota Industrial Commission: \$95,000**



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## APPENDICES

- Appendix A. Draft Project Scope
- Appendix B Project Team Qualifications
- Appendix C Proposed Project Schedule

## LIST OF ACRONYMS

CEM	continuous emissions monitor
DOE	Department of Energy
EPRI	Electric Power Research Institute
ESPs	electrostatic precipitators
GRE	Great River Energy
ICR	Information Collection Request
multi-PoCT	multi-Pollutant Control Test
NDIC	North Dakota Industrial Commission
TC	Tailored Collaboration
US EPA	United States Environmental Protection Agency

## 1.0 Abstract

Great River Energy (GRE) requests funding from the North Dakota Industrial Commission (NDIC) for a project to evaluate options for minimizing or controlling the amount of mercury air emissions from our Stanton Station and Coal Creek Station. The proposed project will:

- Evaluate the concentrations and speciation of mercury in each plant's flue gas before and after existing air pollution control equipment.
- Test a slipstream of flue gas at each plant to determine the effectiveness of various operational changes and air pollution control technologies at minimizing or controlling mercury emissions.
- Assess the feasibility and estimate costs of implementing promising mercury reduction options on a full-scale basis at each plant.

The United States Environmental Protection Agency (US EPA) is slated to determine on December 15, 2000, whether or not to require coal-fired utilities to control air toxics emissions – with a focus on mercury emissions. If the US EPA determines that regulations are appropriate, utilities would have to comply with yet-to-be-proposed emissions control standards by 2007. Over the last ten years, the US EPA and the Department of Energy (DOE) have conducted extensive investigation into mercury emissions from coal-fired utilities. Nevertheless, no cost-effective means of reducing mercury emissions has been developed. The proposed project will help to ascertain if cost-effective means are available for minimizing mercury emissions from lignite-fired utilities. In addition, the project will better define costs for sorbent injection controls, which is generally considered to be the US EPA's technology-of-choice for controlling mercury emissions.

Dr. Ramsay Chang of the Electric Power Research Institute (EPRI) will be the lead investigator for the project. EPRI is the premier organization for research and development in the electric energy industry with more than 25 years of experience.

The total cost for the proposed project is \$190,000. GRE will contribute \$45,000 to the project plus in-kind services such as installing equipment, gathering plant-operating data, and monitoring plant emissions. EPRI will contribute \$50,000 in the form of Tailored Collaboration (TC) Project dollars. We are requesting 1:1 matching funds of \$95,000 from the NDIC's Lignite Research Development and Marketing Program.

## **2.0 Project Summary**

The project for which we are requesting funding is a slipstream study of potential mercury control options at GRE's Coal Creek Station and Stanton Station; both plants fire 100 percent North Dakota lignite coal. The goal of the project is to determine if cost-effective means are available to reduce mercury emissions from lignite-fired utilities.

The principal investigator for the project is EPRI. Dr. Ramsay Chang, EPRI Manager of Particulate & Air Toxics Control, will serve as the project manager. Dr. Carl F. Richardson, Radian International, LLC, and Ms. Sharon M. Sjostrom, Apogee Scientific, Inc., will be retained by EPRI as subcontractors on the project.

The project will entail identification of potentially promising operational changes and air pollution control technologies to reduce mercury emissions from each of the plants. Options for controlling mercury emissions are highly dependent on existing emissions characteristics and plant design. After the most promising site-specific options are

identified, testing of the options will be completed at each of the sites. The study does not look at fuel switching or fuel blending as an option for reducing emissions.

Onsite testing will be done on a 15- to 300-liter-per-minute (0.5- to 10-cubic-feet-per-minute) slipstream of flue gases. EPRI's multi-Pollutant Control Test (multi-PoCT) system, a modular, easily transported system of various control technologies and monitoring systems, will be utilized in this project. Multi-PoCT is capable of being equipped with miniature baghouses, electrostatic precipitators (ESPs), residence time probes (to simulate duct sorbent injection), sorbent tubes, and catalysts. In addition, sorbent injection and exhaust gas cooling can be accomplished with the system. A prototype mercury continuous emissions monitor (CEM) will be used to measure and speciate mercury emissions from the multi-PoCT system.

EPRI will also investigate the potential of using North Dakota lignite as a source for making low cost activated carbon. If feasible, the sorbent will be tested at one of the proposed test sites and compared with commercially available carbon.

EPRI will prepare a report summarizing the mercury reduction options tested and the test results. The report will also assess the cost effectiveness of implementing each tested mercury emissions reduction option on a full-scale basis.

The objectives of the project are to:

- Evaluate the concentrations and speciation of mercury in each plant's flue gas before and after existing air pollution control equipment.



- Test a slipstream of flue gas at each plant to determine the effectiveness of various operational changes and air pollution control technologies at minimizing or controlling mercury emissions.
- Assess the feasibility and estimate costs of implementing promising mercury reduction options on a full-scale basis at each plant.

### **3.0 Project Description**

The project will entail two tasks:

Task 1 - Initial Assessment of Existing Mercury Emissions and Reduction Options

Task 2 - Field Mercury Measurement and Assessment of Selected Control Options

Appendix A contains EPRI's draft project scope, which includes a description of the project tasks.

Under Task 1, GRE and EPRI will review existing mercury emissions and operational data for each plant. Based on this data, we will identify operational changes and control technologies that provide the greatest potential for reducing each plant's mercury emissions. These operational and technology options will be prioritized according to estimated cost effectiveness.

Under Task 2, an actual slipstream of flue gas will be tested. The first phase of testing will be conducted to determine the baseline mercury emissions from each plant. The second phase will entail testing of the mercury reduction options selected under Task 1.

Table 1 outlines preliminary reduction options for testing at each facility. The final test options will be refined during Task 1, and as such, may be different than shown in Table 1.

**Table 1  
Preliminary Test Matrix for GRE Mercury Reduction Options Testing**

<b>Plant</b>	<b>Location</b>	<b>Device/Test</b>
Coal Creek	Plant mercury emissions baseline characterization	Mercury Analyzers
Coal Creek	ESP Inlet	Sorbent Characterization Oxidation catalyst tests
Coal Creek	ESP Inlet	Residence Time Probe(Simulate sorbent injection before ESP) Parametric test varying temp and time 2-3 sorbents (possibly one prepared from North Dakota lignite)
Coal Creek	FGD/ESP Outlet	Gold probe
Stanton	Plant mercury emissions baseline characterization	Mercury Analyzers
Stanton	Baghouse Inlet	PoCT Baghouse Parametric test varying temp and time 2-4 sorbents

A report will be prepared under Task 2 that will summarize the results of the testing. The report will summarize:

- the characterization of the existing flue gases upstream and downstream of air pollution control equipment
- a description of each mercury reduction option tested and the range of operating conditions tested for each option
- the changes in the mercury speciation and concentrations resulting from each reduction option tested
- an estimate of costs for implementing each successful reduction option on a full-scale basis

## 4.0 Standards of Success

The purpose of the proposed project is to obtain sound technical data on selected methods for minimizing mercury emissions and the costs associated with each of the tested methodologies. Successful culmination of this project will be attained with the delivery of the final report.

The Project Team has been selected in part due to their exceptional expertise in ensuring credibility and validity of research data. Dr. Ramsay Chang as Project Manager will be responsible for ensuring that the appropriate resources and personnel are available for the study to yield sound and valid data.

## 5.0 Background

Mercury in the environment - and specifically mercury releases to the environment from coal-fired utilities - is increasingly becoming a prominent public issue. Mercury is a known neurotoxin, although the exposure level that is toxic to humans is being debated and researched. Nevertheless, 40 states, including North Dakota, have deemed it necessary to establish fish consumption advisories due to presence of methylmercury in certain fish species.

Mercury is an element that can neither be created nor destroyed by man. Mercury is naturally present in lignite. Combustion of the lignite releases the mercury from the coal as an air emission. EPA estimated in its report to Congress<sup>1</sup> that 51.6 tons of mercury

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<sup>1</sup> U.S. Environmental Protection Agency. Mercury Study Report to Congress. Volume II. An Inventory of Anthropogenic Mercury Emissions in the United States. Office of Air Quality Planning and Standards and Office of Research and Development. 1997.

were emitted from coal-fired utilities in 1994. Total emissions from North Dakota utilities were estimated at 1.219 tons (2,438 pounds). Newer data suggests that EPA may have underestimated the mercury emissions from North Dakota. In its report to Congress, EPA recommended additional data gathering. EPA's subsequent Information Collection Request (ICR) program required utilities to quantify the mercury content of coal shipments received by them. In addition, several utilities were required to perform stack emissions testing to measure the mercury concentrations in their flue gas both before and after each unit's primary air pollution control systems. All North Dakota utilities were required to test at least one unit at each of their power plants. EPRI's preliminary review of the first two quarter's worth of data indicates that the mercury concentration in North-Dakota-consumed coal is approximately 150 percent higher than EPA had estimated in its report to Congress. This could potentially correlate to North Dakota having 1994 emissions of 1.8 tons (~3,600 pounds) if EPA's original control efficiency estimates were correct.

Pursuant to a settlement agreement between EPA and the Natural Resources Defense Council, EPA is required to determine by December 15, 2000, if it's appropriate to require utilities to control their hazardous air pollutant emissions - with a focus on mercury emissions. If EPA determines to regulate utility emissions, regulations would have to be proposed by December 15, 2003, and promulgated by December 15, 2004. Utilities would likely have to have controls in place and comply with the final regulations by 2007. It is generally believed that EPA will determine that regulations are appropriate and that their presumptive control technology is sorbent injection.

Sorbent injection is a very expensive control strategy. Based on information developed by EPRI, it would cost \$5,000 to \$50,000 per pound of controlled mercury. This could translate to annual costs of \$500,000 to \$5 million for a 500-megaWatt power plant.

## **6.0 Qualifications**

Qualifications for EPRI and its subcontractors are presented in Appendix B.

## **7.0 Value to North Dakota**

The lignite industry plays a significant role in North Dakota's economy. In order to maintain this role, it is important to ensure that lignite remains competitive with other fuel sources. This study will generate data that could prove useful in developing cost-effective, competitive options for reducing mercury emissions from lignite-fired utilities. The study will look at the viability of producing activated carbon from lignite, which could then be used in controlling mercury emissions.

The project data could also prove useful in the development of air toxic control standards if EPA were to determine in December 2000 that regulations are appropriate. Such data could include the feasibility of specific technology options for controlling mercury emissions from lignite-fired utilities and the economics of specific technology options.

## **8.0 Management**

Dr. Ramsay Chang, as the Project Manager, will be responsible for directing the project schedule and subcontractors. He will ensure that the project proceeds in a timely manner and within the project budget of \$190,000. Dr. Chang will also lead the project team in preparing the draft and final reports.

GRE's environmental and engineering staff will be involved in the selection of control options and will remain fully apprised of the project status and goals. GRE staff will review and comment on all draft project reports prior to finalization.

## 9.0 Timetable

Testing at each facility is expected to occur over a 2- to 3-week period. We anticipate starting on-site testing (Task 2) in mid- to late October 2000 or early November 2000. Task 1 will start immediately upon contract approval, with final selection of testing options being determined at least two weeks prior to initiating on-site testing. Appendix C contains a Gantt Chart showing the proposed project schedule.

## 10.0 Budget

Project charges are on a lump sum basis not to exceed \$190,000. EPRI shall invoice GRE upon execution of a "Collaborative Funding Agreement". GRE requests that NDIC distribute the requested funds according the following schedule:

<u>Milestone</u>	<u>Distributed Funds</u>
1. Contract Singing by GRE/EPRI	\$25,000
2. Delivery of Task 1 Options Report	\$25,000
3. Completion of On-Site Testing	\$25,000
4. Delivery of Final Report	<u>\$15,000</u>
TOTAL	\$95,000

The project budget includes only charges associated with conducting and managing the project. Time and expenses incurred during the development of contracts and this application are not charged to the project budget and will not be submitted to NDIC for reimbursement.

## 11.0 Matching Funds

Following is a summary of funds for the proposed project:

Great River Energy Cash	\$ 45,000
GRE/EPRI TC Matching Funds	<u>\$ 50,000</u>
<b>Industry Total</b>	<b>\$ 95,000</b>
North Dakota Lignite Research, Development and Marketing Fund	<u>\$ 95,000</u>
<b>Total Project Funding</b>	<b>\$190,000</b>

## 12.0 Tax Liability

I, Doug Paumen, certify that Great River Energy does not have any outstanding tax liability owed to the State of North Dakota or any of its political subdivisions.

Doug Paumen  
Doug Paumen  
Manager, Accounting Services

5/19/00  
Date

## 13.0 Confidential Information

A final report will be prepared summarizing the project and its findings. All information contained in the final report will be made available to the public without any limitations of confidentiality.