FY-XXVIII-79
MERCURY FORMATION AND FATE

CONTRACTOR: Energy & Environmental Research Center

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PARTICIPANTS

Sponsor	Cost Share
Minnkota Power Cooperative	$30,000
Cooperative Power Association (Great River Energy)	$30,000
U.S. Department of Energy (JSRP)	$200,000
Electric Power Research Institute	$30,000
ND Industrial Commission	$120,000
Total Project Costs	$400,000

Project Schedule - 9 Months
Contract Date - 4/29/1998
Start Date – 4/29/1998
Completion Date – 4/1/99

Project Deliverables
Status Report – 8/31/98 ✓
Status Report – 11/30/98 ✓
Final Report – 4/1/99 ✓

OBJECTIVE / STATEMENT OF WORK

The objective of this project was to determine the abundance and forms of mercury in flue gas emitted from lignite-fired power plants and to determine the source of mercury in a regional lake. The abundance and forms of mercury emissions from two North Dakota lignite-fired power plants was determined. The two power plants are Milton R. Young Station, Minnkota Power Cooperative and Coal Creek Station, Cooperative Power Association (Great River Energy). Sediment core samples were obtained from a regional lake located east of the coalfields of North Dakota. The core sample was submitted to Frontier Geosciences, Inc. of Seattle, Washington for analysis.

STATUS

The following conclusions were drawn from the results of the testing at Milton R. Young Station:

- The mercury emitted at the stack is about 10% oxidized mercury (Hg^{+2}) and 90% elemental Mercury (Hg^{0}).
- The FGD system, whether utilizing fly ash or lime as the sorbent, removes almost all the Hg^{+2} but little if any Hg^{0}.
- It appears that the ESP removes about 5% of the mercury and another 5% of the Hg^{0} is converted to Hg^{+2} across the ESP.
- The mercury emission factor for Unit 2 of the Milton R. Young Station was 8.74±0.81 lm/10^{12} Btu.

The following conclusions were drawn from the results of the testing at the Coal Creek Station:

- The mercury at the FGD inlet is about 30% Hg^{+2} and 70% Hg^{0}.
- The FGD system removes almost all the Hg^{+2} but little if any Hg^{0}.
- The ESP converts 20% of the Hg^{0} to Hg^{+2}.
- The mercury emission factor for the Coal Creek Station was an average 8.57±1.01 lb/10^{12} Btu.

Bottom-lake sediments were characterized from two locations in the regional lake. Mercury, trace metal, and organic content was analyzed in bulk samples and 63-micron fractions from cores collected in Bay A and Bay B. ^{210}Pb modeling and pollen analysis were conducted to support chronological assessment of sediment accumulation and elemental distribution. A brief description of selected details is:

- Mercury concentration in Bay A ranges from 30-66 ng/g and for Bay B 42-140 ng/g.
- A significant difference in mercury concentration and the time frame of deposition between Bay A and Bay B is associated with a wastewater discharge to Bay B from the city adjacent to the regional lake.
- Mercury in core samples correlates with As, Cd, Cu, Zn, organic content and the presence of a finer solid fraction.
- The increase in mercury and other elemental species does not provide sufficient evidence for determining specific anthropogenic (human-induced) sources. Observes trends do correlate well with intensifying deposition of fine sediments due to changing agricultural practices.
- Human-induced or anthropogenic sources such as the regional lignite-fired power plants affecting mercury deposition in this specific lake are masked by local geochemistry, organic reactions, and diagenetic processes.