FY98-XXX-83
MATCHING COAL QUALITY AND BOILER OPERATION

CONTRACTORS: BNI Coal, Ltd.;
Minnkota Power Cooperative (MPC); and
Microbeam Technologies, Inc. (MTI)

CO-PRINCIPAL INVESTIGATORS:

William Peterson (for BNI Coal, Ltd.)
Phone: (701) 794-8734
Fax: (701) 794-3125
BPeterson@bnicoal.com

Richard Schwalbe (for MPC)
Phone: (701) 794-8711
Fax: (701) 794-7258
dschwalbe@minnkota.com

Steven Benson, Ph.D. (for MTI)
Phone: (701) 777-5000
Fax: (701) 777-5181
sbenson@microbeam.com

PARTICIPANTS

Sponsor	Cost Share
BNI Coal, Ltd.	$524,565.51
Minnkota Power Cooperative	$442,799.28
ND Industrial Commission	$260,050.49
Total Project Cost	$1,227,415.28

Project Schedule – 18 Months
Contract Date – 4/9/98
Start Date – 4/9/98
Completion Date – 5/31/00

Project Deliverables
Status Report: July 1, 1998 ✓
Status Report: October 1, 1998 ✓
Status Report: January 1, 1999 ✓
Status Report: April 1, 1999 ✓
Status Report: July 1, 1999 ✓
Status Report: Jan 2, 2000 ✓
Final Report: May 31, 2000✓

OBJECTIVE / STATEMENT OF WORK

The primary goal of this project is to reduce oil consumption in cyclone-fired boilers by 1) increasing coal quality control, 2) optimizing boiler operations and 3) evaluating boiler design.

STATUS

Preliminary conclusions are:

- Fuel oil usage for cyclone slagging in MRY Unit 2, the demonstration facility for the project, has decreased by 90%, from 2,697,840 million gallons in 1996 to 267,044 gallons in 1999.
- Cyclone slagging (excessive slag build-up in a cyclone) occurs when cyclone combustion temperature is less than the temperature required to melt and tap the coal ash from the cyclone. When excessive slag build-up in a cyclone occurs, oil is fired to raise the cyclone combustion temperature and melt the slag accumulation.
- Cyclone slagging incidents result from a combination of both coal quality and boiler operations.
- A program to reduce oil burning began in December 1997 in addition to the work conducted in this project. The work conducted through the combined programs focused on boiler optimization while determining the effects of coal quality on cyclone performance. Boiler optimization has been responsible for reducing cyclone slagging significantly. Reduction in oil burning due to changes in as-burned coal quality during the 1996-1999 period is more difficult to quantify.
- The impacts of coal quality and boiler operating conditions on cyclone performance in the Unit 2 boiler for a series of test burns from Aug. 98 to Jul. 99 were determined through collection and analysis of as-burned coal samples and the Unit's OTIS data.
- Boiler operating parameters found to have the most significant impact on oil burning include: predry air flow rate, predry air temperature, coal flow rate, air flow rate, and excess air based on analysis of operational data. Operation of the predry air system was optimized and it significantly reduced oil burning.
- Coal quality parameters associated with cyclone slagging incidents include: high T_{250} values, high illite clay content, low base/acid ratio, high ash content, and low heating value.
- Base-to-acid ratio is determined by the chemistry of the ash. The quantity of ash present in the coal is a result of the inherent ash content of the coal and any dilution caused by mining practices.
- Slag viscosity (T250), used to estimate the ability to tap slag from cyclones, was found to change significantly with changes in coal ash composition (base/acid ratio). Limitations were found in the ability of the calculation method to predict slag viscosity accurately for the range of composition of the lignite fired.
- An improved method of predicting viscosity for the wide range ash composition was developed and is currently being tested at Minnkota.