LRC-II-11
PROJECT SODIUM

CONTRACTOR: Energy & Environmental Research Center

PRINCIPAL INVESTIGATOR: Michael L. Jones
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PARTICIPANTS

Sponsor	Cost Share
Cosponsors	$215,000[1]
Minnkota Power Cooperative	
Northern States Power Company	
Montana-Dakota Utilities	
Otter Tail Power Company	
Knife River Mining Company	
Westmoreland Mining Company	
ARCO Coal Company	
Pacific Power Company	
Nerco Mining Company	
Diamond Power[2]	
ND Industrial Commission	25,000
Total	**$240,000**

Project Schedule – 1 Year
- Contract Date – 8/23/89
- Start Date – 10/20/88[3]
- Completion Date – 1/92 (delayed)

Project Deliverables
- Progress Reports ✔
- Final Report – 1/92 ✔

OBEJCTIVE / STATEMENT OF WORK

Project Sodium, as proposed, was a five-year multiclient program. The work proposed under this application was for the fourth year of the five-year program. This was the first year of participation for the North Dakota Industrial Commission.

[1] Total cosponsor funding for the entire project was $1,075,000. During the period funding was provided by the Commission, the cosponsor funding was $215,000.

[2] Diamond Power was a participant in previous years, but was not a participant during the time the Commission was providing funds.

[3] The original start date of the program was 8/23/86. During this funding period the start date was 10/20/88.

A principal operating problem in using North Dakota lignite is ash deposition. Sodium in coal is the primary component in coal linked to ash deposition in the convection pass of boilers fired with lignite. The objective of Project Sodium is to understand the role of sodium in coal combustion processes. A specific goal of Project Sodium in 1988 was ash modification to affect the fouling and slagging properties of coal. Another goal was to begin developing a model of ash behavior as a function of coal composition and combustion conditions.

STATUS

Two distinct chemical mechanisms were identified for the growth of strong deposits from the coal tested, involving sodium-rich surfaces that are in juxtaposition. Information was developed to show the roles of chemical reaction, phase equilibria, and viscosity on deposit formation. A computer code, PHOEBE, was developed to predict the equilibrium phase behavior of the inorganic material in coal.

The well-known causative effect of sodium was explained by the properties of silicate and sulfate phases, particularly by those formed from aluminosilicate clay species. Research was directed toward mitigation of the deposition process by changing 1) volatility in the flame, 2) crystallization of liquid phases, or 3) the physical structure of solids. Test data demonstrated success at reducing the severity of ash deposits on the bench-scale (drop-tube furnace) and in pilot-scale combustion tests by using proprietary additives.