

LMFS-94-12
UPGRADED LIGNITE PERFORMANCE TESTING

CONTRACTOR: Babcock & Wilcox

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CONTRACT AMOUNT: \$74,951

Project Schedule - 1 Year

Contract Date - 1/5/94

Start Date - 1/5/94

Completion Date - 12/31/94

Project Deliverables

Status Report - 3/31/94 ✓

Status Report - 6/30/94 ✓

Status Report - 9/30/94 ✓

Final Report - 12/31/94 ✓

OBJECTIVE / STATEMENT OF WORK

The objective of this study was to assess the impact of upgraded lignite as a blending stock in existing utility power plants. A goal of this study was to develop detailed information on the actual behavior of upgraded North Dakota lignite (UNDL) fuel blends under commercial utility boiler conditions. A baseline test was performed with a blend of Powder River Basin (PRB) and bituminous coal. The PRB/UNDL blends were compared to the bituminous/PRB blend.

Specific objectives were to:

- evaluate fuel handling and pulverizer performance;
- evaluate burner characteristics;
- evaluate flame shape, length and stability;
- determine the convection pass fouling and heat transfer losses; and
- evaluate soot blowing pressure and soot blowing frequency.

The statement of work was for a maximum of three UNDL samples and four blending tests. The coal was chemically characterized by proximate, ultimate, elemental ash, Btu and ash fusion analyses. Tests were performed in a combustion pilot plant rated at 5 MBtu/hr of heat input or 500 lbs/hr of coal feed. Data was collected, analyzed and reported for each of the four tests.

STATUS

The project was initiated on January 5, 1994. The PRB coal selected for this program is from the Decker Mine in Montana. The bituminous coal is from the Ohio No. 6 seam. The three North Dakota lignites are from the Gascoyne Mine of Knife River Coal Mining Company (KRCMC), the Beulah Mine of KRCMC and Falkirk Mine of The Falkirk Mining Company. The Gascoyne Mine lignite was upgraded at the SynCoal⁷ demonstration plant at Rosebud, Montana. The Beulah Mine lignite was upgraded at EERC by a physical cleaning scheme developed under the lignite research, development and marketing program project FY94-XV-53. The Falkirk Mine

lignite was upgraded by EERC's hot-water drying (HWD) technology. Test quantities of the Beulah and Falkirk lignite were produced at EERC under the lignite research, development and marketing program project LMFS-94-15. The upgraded lignite samples were delivered to B&W by mid-October. Combustion tests were conducted at B&W's 5 MBtu/hr small boiler simulator (SBS) located in Alliance, Ohio the week of November 14, 1994.

Air toxics removal using an integrated flue gas treatment concept was evaluated during the combustion testing of the upgraded coal blends under lignite project FY94-XVII-56.

Findings include the following:

Fuel Handling No spontaneous combustion was encountered. The Knife River Blend required the least handling due to small size distribution. The other two blends were briquetted and required size reduction. Overall, no problems were encountered in handling and grinding.

Burner & Flame Characteristics No observed differences in flame appearance between baseline and blended coal tests, both producing stable flames of 5.2 ft to 6 ft.

Emissions NO_x levels were lower or the same and CO levels were within normal ranges for both blended and baseline coals. SO₂ and unburned carbon levels were lower in upgraded North Dakota lignite coal blends than in the bituminous coal blend, except the Falkirk/HWD blend was slightly higher in unburned carbon.

Furnace Exit Gas Temperatures (FEGT) Values were slightly higher with the Beulah and Falkirk upgraded North Dakota lignite blends. The higher FEGT may have been due to thickness of slag on the furnace walls and other changes in the furnace. The higher FEGT was not due to coal combustion performance.

Superheater Tube Bank Heat Absorption Except for the Falkirk blend, heat absorption decreased faster with the UNDL blends than with the baseline blend.

Sootblower Frequency and Pressure Increases in sootblower cycle frequency are required with the Knife River and Beulah blends. No sootblower pressure increases are necessary with the UNDL blends.

Recommendations:

- Use care in handling of UNDL to reduce the potential for spontaneous combustion (e.g. CO₂ blanket).
- A review and potential upgrading of existing sootblower systems should be conducted.
- It is necessary to quantify the effects of fuel binder on grinding and handling of Falkirk coal.
- Use of UNDL coals in cyclone fired boilers merits further investigation (no grinding required).