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High Sulfur Coal
Fuel Switch Study

For

American Electric Power
Big Sandy Unit No. 2

AEP Service Agreement No. 395977X117
FWNAC Contract No. 65-129093-00
November 2011

FWNAC ENGINEERING REPORT NO S-11-104

NOTICE

This report was prepared for a specific client, American Electric Power (AEP), pursuant to AEP Service Agreement No. 395977X117 and Foster Wheeler Contract No. 65-129093-00.

The contents of this report are not intended to provide any information, apparatus, method or process for use by any individual or organization other than the client for whom this report was prepared.

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INTRODUCTION

The AEP Big Sandy Unit #2 is an 800MW, pulverized coal fired, Foster Wheeler supercritical, double reheat boiler located at Big Sandy Kentucky. The unit was originally designed for 5,280,000 pph continuous main stream flow at 1010°F and 3700 psig. The first reheater (high pressure) was originally designed for 1025°F outlet steam temperature, while the second reheater (low pressure) was designed for 1050°F.

American Electric Power (herein called “AEP”) is considering firing two high iron fuels (Radio Hill and McElroy) in their Big Sandy Unit #2. Both coals are classified as having a high furnace slagging potential. Recognizing the possible adverse consequences related to firing these fuels, AEP has contracted Foster Wheeler North America Corp. (herein called “FWNAC”) to evaluate the unit performance when firing said high iron coals and recommend either operational (load reduction) or furnace surface changes/additions that would allow for the firing of Radio Hill or McElroy coals.

As part of a previous study performed by FWNAC for AEP’s Mitchell Units, the impact of firing high iron coals was investigated. Basic conceptual recommendations were made regarding the addition of both a furnace nose and wing wall furnace surface that would accommodate the firing of said fuels. While the previous effort was somewhat cursory in nature, the effort of this study was intended to be more comprehensive and detailed. This report summarizes and presents the results of this more comprehensive evaluation.

SCOPE OF STUDY

Execution of this study encompassed four phases. The first phase was to determine the boiler's thermodynamic characteristics via the analysis of thermal performance test data provided by AEP. The Big Sandy Unit #2 currently does not have a furnace nose installed, but future plans provide for the possible installation thereof. Additionally, neither of the fuels in question (or blends thereof) are currently being fired at Big Sandy. AEP's Mitchell Units (sister units of Big Sandy), however, are firing a blend of Birch River and McElroy coals – the latter being a coal considered in this study. The blend percentage (65% Birch River / 35% McElroy) is selected in a way which allows for operation at MCR load while allowing for controllability of furnace cleanliness. Additionally, the Mitchell Units have had furnace noses installed. Therefore, it was decided, for purposes of this study, that thermal performance test data would be collected and analyzed from the Mitchell Units and the results used to project performance for the Big Sandy Unit #2. Please refer to Table #1 and Table #2 for a fuel and ash analysis for all three of the coals and coal blends referred to in this report.

The second phase was to use the results of the aforementioned test data analysis for predicting performance of the Big Sandy Unit #2 with a furnace nose installed when firing the coal blend being fired at Mitchell.

It is recognized that furnace exit gas temperature (FEGT) is an indicator of furnace cleanliness as impacted by coal quality slagging characteristics. With this in mind, the third phase of the project was to determine, and predict performance for, what load reduction would be required to allow for the firing of either Radio Hill or McElroy coals without the need for unit modifications, with the "controlling" factor being the FEGT. Similarly, the fourth phase of this project was to determine what furnace surface additions would be required to allow for MCR operation of the unit when firing either Radio Hill or McElroy coals at full load. Along with the test data analysis, these last two phases were also based upon work performed by Dave Tillman, a consultant for Foster Wheeler, regarding the characteristics of the fuels in question as summarized in his report, which was previously issued on September 8, 2011. In his report, Mr. Tillman provided his assessment of the impact of firing either Radio Hill or McElroy coals on FEGT, thus giving guidance for predicting performance and determining surfacing requirements.

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Summary of Coal Analyses
Provided by AEP
Table 1

Coal	Coal Blend of July 15, 2010 Test Data from Mitchell #1	Radio Hill	McElroy
Mine	65 / 35 Birch River & McElroy	Kentucky #11 seam, Muhlenburg,KY	Pittsburgh #8 seam, West Virginia
# SO2/mmBTU	**3.55**	**5.65**	**6.68**
PROXIMATE ANALYSIS (As Rec'd)			
MOISTURE	5.31%	12.01%	5.50%
VM	32.95%	38.58%	36.58%
FC - Difference	48.47%	41.29%	45.07%
ASH	13.27%	8.12%	12.85%
SULFUR	2.16%	3.28%	4.04%
BTU	12,181	11,607	12,100
PROXIMATE ANALYSIS (DRY)			
VM (DRY)	34.8%	43.85%	38.71%
FC (DRY) - Difference	51.18%	46.93%	47.69%
ASH (DRY)	14.02%	9.23%	13.60%
SUL (DRY)	2.28%	3.73%	4.28%
BTU (DRY)	12,864	13,191	12,804
BTU (MAF)	14,961	14,532	14,819
ULTIMATE ANALYSIS (As Rec'd)			
CARBON	66.9%	63.00%	66.15%
HYDROGEN	4.55%	4.35%	4.39%
NITROGEN	1.27%	1.32%	1.20%
OXYGEN (DIF)	6.44%	7.91%	5.80%
CHLORINE	0.10%	0.01%	0.07%
ULTIMATE ANALYSIS (DRY)			
CARBON	70.65%	71.60%	70.00%
HYDROGEN	4.81%	4.94%	4.65%
NITROGEN	1.34%	1.50%	1.27%
OXYGEN (DIF)	6.79%	8.99%	6.14%
CHLORINE	0.11%	0.01%	0.07%

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Summary of Ash Analyses
Provided by AEP
Table 2

Coal	Coal Blend of July 15, 2010 Test Data from Mitchell #1	Radio Hill	McElroy
Mine	65 / 35 Birch River & McElroy	Kentucky #11 seam, Muhlenburg,KY	Pittsburgh #8 seam, West Virginia
# SO2/mmBTU	**3.55**	**5.65**	**6.68**
Al2O3	25.84%	20.03%	20.68%
SiO2	53.13%	44.46%	45.51%
TiO2	1.38%	1.09%	0.88%
SUM ACID	80.35%	65.58%	67.07%
Fe2O3	10.78%	27.90%	24.08%
CaO	1.57%	1.96%	3.17%
Na2O	0.33%	0.25%	0.57%
MgO	0.73%	0.63%	0.77%
K2O	2.35%	2.08%	1.86%
SUM BASE	15.75%	32.82%	30.45%
P2O5	0.23%	0.05%	0.38%
SO3	1.07%	1.38%	2.58%
UNDETERMINED (DIF)	2.59%	-.02%	-0.48%
GRINDABILITY (HGI)	47	51	57
ASH FUSION TEMPERATURES			
IDT (RED)	2474	1970	2032
ST H=W (RED)	2487	2000	2071
H H=1/2 W (RED)	2531	2150	2201
FT (RED)	2550	2320	2256
IDT (OX)	2618	2490	2458
ST H=W (OX)	2637	2520	2513
H H=1/2 W (OX)	2647	2550	2543
FT (OX)	2654	2600	2565

CONCLUSIONS

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DISCUSSION

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