

A CHEMICAL APPROACH TO THE CONTROL OF UNBURNED CARBON IN FLY ASH

**Joseph Pircon & Anupam Sanyal
Benetech, Inc., Montgomery, Illinois**

USA has approximately 300,000 MW coal fired installed capacity and fires some 900 million tons of coal and lignite per annum. Almost all units apply NO_x control measures, majority of which adopt in-furnace control by Low NO_x burner, Overfire air, etc. An undesirable consequence of these measures is increase in the unburned carbon (UBC) in fly ash. Reduction of 1% point of unburned carbon will save approximately 1 million tons of coal per year in the USA.

A chemical which has been in use by the utility industry to improve heat rate of units, experiencing low superheat and reheat steam temperature, has been found to also substantially reduce the UBC content of fly ash.

When high ash fusion temperature Eastern coal is fired in generously designed furnaces of PC units, the clean slag-free water wall absorbs heat in excess of its design value. As a result, the furnace exit gas temperature reduces significantly leading to low superheat and reheat steam temperature and consequently low cycle efficiency and high high rate.

A granular chemical is injected in very small quantity to the furnace water wall above the top burner level to initiate a slag layer which reduces heat transfer. A 1" thick slag layer has been estimated to increase the furnace gas temperature by 200°F. The high gas temperature improves the combustion efficiency and reduces UBC level in fly ash.

The product has been in use for over 10 years in 11 wall and corner fired units (53 to 880 MW) of 9 utilities. It has shown no detrimental effects on the boiler tube or on the bottom ash and fly ash. It poses no environmental concern.

The chemical is injected through the existing furnace inspection ports above the top burner level by means of an educator and station air. In every unit, the UBC has been found to reduce from a minimum of 4% point (9% before, to 5% after application) to 18% point (from 25% down to 7%), in some cases.

Based on EPRI's guideline of heat rate improvement due to reduction in unburned carbon level of fly ash, a 4% reduction for a 500 MW unit, relates to a savings of approximately 7,000 tons of coal per annum or over \$200,000 a year. A reduction in UBC content has also made it possible for utilities to sell their fly ash. Thus, some 150,000 tons of fly ash generated annually by a 500 MW unit firing 10% ash coal will bring in additional revenue of \$450,000 per year at \$3/ton.