CONTROL OF COAL FLOW DISTRIBUTIONS FROM COAL PIPE SPLITTERS

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ABSTRACT

Unbalanced burners can cause a variety of operating problems in pulverized coal boilers, such as high fly ash unburned carbon, high levels of CO, local slagging, and premature failure of burners. Unbalanced burners can also make it necessary to operate with higher average O_2 levels in the furnace, thus limiting the NO_x reductions which can be achieved through combustion optimization. The ability to balance burners depends on the availability of accurate measurements of coal flow rate in individual pipes; and several vendors offer instruments for this application. If an imbalance is detected, then adjustments need to be made. One approach which has been used with some wall-fired boilers is to adjust secondary air registers to compensate for imbalances in coal flow rate to individual burners. The present paper deals with the development of a technology for making on-line adjustments to the coal flow rates to individual burners. The approach is applicable to piping systems with splitters in which a single pipe is split into two, three or even four pipes. The method makes use of a riffler installed in the splitter box with adjustable flow control elements positioned upstream of the riffler.

CFD simulations and laboratory experiments were used to develop the flow control technology. Experiments carried out in a pulverized coal flow test facility at the Energy Research Center were used to verify the ability of the technology to adjust the distribution of the coal flows and achieve closely balanced outlet flows.

Laboratory results are presented for two-, three-, and four-way splitters, demonstrating the ability to achieve balanced coal flow rates among the outlet pipes. As the results show, this can be done without affecting the distribution of primary air, which is necessary for achieving balanced burners.

In the laboratory trials, the flow control elements were adjusted manually from outside of the coal pipe while the test loop was in operation. In a power plant, the adjustments would be made either manually or automatically; and this would be done while the boiler is operating.

With this approach, burner balancing would be carried out in three steps. First, the primary air flows would be balanced using orifices located in the coal pipes. The coal flow rates would then be balanced using the adjustable flow control elements; and finally, the secondary or auxiliary air registers would be adjusted to balance the overall fuel-to-air ratio at the burners.