Case Study

Burner and Boiler Component Replacement

BMA has been mandated to carry out a project to retrofit two 300 MW boiler. This project involved the substitution or re-design of some boiler pressure components, the substitution of non-pressure components, the replacement of burners, and the installation of a new DCS.

The original boilers came into commercial operation in 1975. However, due to various deficiencies found in the original boiler design, these boilers never reached MCR condition. According to the recommendations of a previous engineering study in 1990, some modifications to the boilers were made, which allowed them to operate continuously at 250 to 270 MW, and with the upcoming rehabilitation, they were expected to reach their original design capacity of 300 MW, as well as meet the new pollutant emissions limits.

In order to reach these news limits, BMA proposed the installation of an Over Fire Air (OFA) system along with a Flue Gas Recirculation (FGR) system. These systems are known to be key factors in the reduction of pollutant emissions. Using Computational Fluid Dynamic (CFD) and burner expertise, BMA designed and validated these systems for the original design capacity of 300 MW, taking into account the fuel oil composition and the furnace geometry (12 front and height rear John Zink burners).

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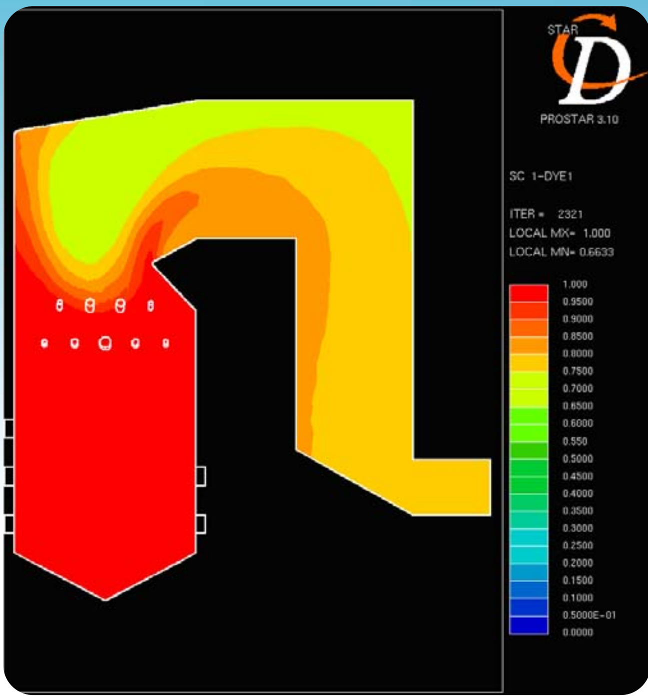

The OFA system is crucial for reducing the formation of fuel nitrogen oxides (NO_x), and completing the combustion above the highest row of burners. As a fraction of the combustion air is injected into the part of the combustion chamber above the burners (secondary combustion zone), the amount of combustion air flowing through the first burner stage is reduced, decreasing the O_2 concentration where fuel is in high concentration and thus reducing the flame temperature. Since this operation will increase the amount of unburned fuel at the burner level, the remaining combustion air injected at the OFA level will allow the completion of the combustion reaction, therefore avoiding high flame temperatures and yielding a better heat distribution. This greatly reduces the production of NO_x. Moreover, the FGR added at the OFA level serves as a dilutant for the hot gases, further reducing the high temperature regions and therefore the production of NO_x.

CFD analysis was used to virtually test different configurations of OFA/FGR systems. Mixing of the OFA jets with the combustion products from the 20 burners was then visualized and analyzed in order to determine the best OFA port configuration possible.

The optimal OFA/FGR systems configuration was designed by BMA. Combustion linked particulate matter emissions were minimized by this design because of the efficient mixing of the OFA and primary combustion products in the upper furnace.

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