



REDUCTION OF NOx EMISSIONS FROM BARK BOILERS

The reduction of NO_x emission from a bark boiler can be predicted by computer simulation. The NO_x emission model can compute the creation and evolution of NO_x from fuel (fuel-NO_x), and from high temperature zones where atmospheric nitrogen may undergo oxidation (thermal-NO_x). The NO_x model allows to analyze typical operational conditions of a boiler (baseline case), and to propose modifications of the firing practices with the ultimate goal of reducing the NO_x emissions. One of most common problems encountered in a typical bark boiler is improper split of the air between undergrate air (UGA), overfire air (OFA) and burners cooling air (BCA). Special attention should also be paid to the OFA jets, which are responsible for providing good mixing conditions in the middle section of the furnace. Many of the older boiler were not designed to fulfill the today's EPA emissions requirements, and they also suffer from overall poor mixing conditions and low thermal efficiency. In most cases the older boilers can be upgraded to the today's standards at relatively low cost, which would be repaid quickly by higher efficiency and lessened environmental problems. The computer simulation can be used to check the proposed modifications to the boiler in advance, giving high assurance of successful boiler upgrade. The decision of the mill management to modernize a bark boiler would be supported by the results from the computer model.

EXAMPLE

Figure 1 shows distribution of NO_x in a typical bark boiler. In this study case, the main source of the NO_x is fuel-nitrogen. The computer model predicts the rates of nitrogen-compounds release during pyrolysis and char burning, and also tracks number of reactions that generate or destroy NO_x. The modified case has the objective to explore the possibility of the NO_x reduction. The undergrate air was reduced by 20%, and the overfire air was increased respectively so that overall air flow remain the same as in the base case. Additionally, the OFA jets were interlaced to improve mixing in the middle section of the boiler. The modifications resulted in the reduction of the NO_x emissions from 64 lb/hr (141 ppm) in the base case to 46 lb/hr (102 ppm) in the modified case. The distribution

of CO in the boiler can be seen on Figure 2. Thanks to improved mixing conditions the CO concentration in the upper boiler is lower for the modified case, which decreases the danger of 'smoking' (soot in flue gas). The improved mixing conditions allow also reducing the excess air necessary to complete combustion which would result in a more efficient boiler

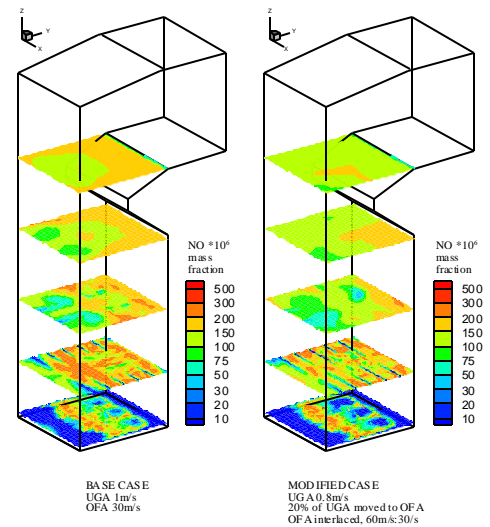


Figure 1: NO_x emissions

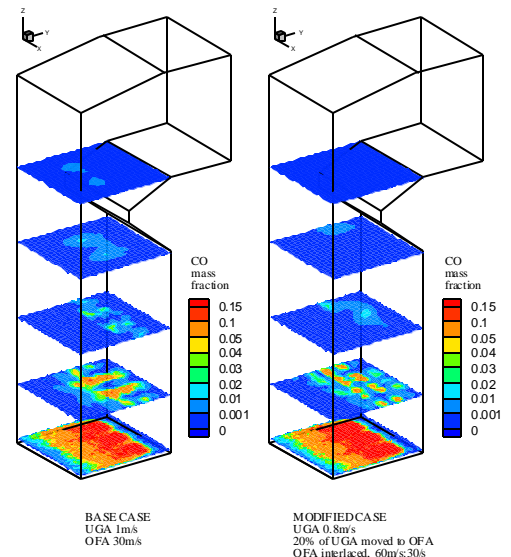


Figure 2: Carbon monoxide distribution

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