2007 **Title:** **Optimizing CO and NO_x Emissions from Hog Fuel Boilers**

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Presented: 2007 TAPPI Engineering, Pulping & Environmental Conference

Ref. No.: TP2007A

ABSTRACT:

Most pulp and paper mills have boilers that burn hogged fuels to generate steam for mill use. The use of these fuels is important for off-setting the costs of purchasing fossil fuels and for disposing of wastes. Emissions from hog fuel boilers that are commonly regulated include carbon monoxide (in the range of 300 ppm to 800 ppm) and nitrogen oxides (ranging from less than 0.1 lb/million Btu to over 0.40 lb/million Btu). Nitrogen oxide (NO_x) emissions can be reduced by decreasing excess air but after a certain point this will lead to an increase in carbon monoxide (CO).

In an example shown in this paper, NO_x was reduced from 0.32 lb/million Btu at 6% O_2 to 0.18 lb/million Btu at 3% O_2. However, at 3% O_2, CO increased to over 2,000 ppm. Many boilers have poorly designed combustion air systems resulting in poor mixing of air and combustibles. As a result, the boilers are fired with too much excess air, particularly undergrate air. This increases the amount of particle carryover as well as NO_x emissions.

Computational Fluid Dynamics (CFD) models can be used for designing improved combustion systems for hog fuel boilers. Recent work has resulted in enhanced algorithms for prediction of CO and NO_x. The algorithms are based on fundamental equations which are then refined using data from operating hog fuel boilers. Modeling CO predictions for approximately 20 hog fuel boilers gave qualitative agreement with measurements, but also point to boiler operating factors such as unsteady or non-uniform fuel and air delivery that cannot be easily replicated in models. Quantitative calculations of NO_x emissions are challenging, but algorithms incorporated in CFD models show the mechanism of air staging on NO_x formation.

Before and after air system upgrade comparisons of emissions from hog fuel boilers are often not meaningful due to differences in operating conditions and changes in boiler configuration. CFD models can also be useful in projecting intermediate or theoretical operating conditions for making more direct comparisons. In one example of an air system upgrade, where data was available, O_2 could be decreased to 3% without any increase in CO above 200 ppm. At this level of excess air, NO_x was approximately 0.26 lb/million Btu.