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2017 **Title:** **A Flame Based Approach for Modeling NO_x Emissions from Recovery Boilers**

Authors: Allan R. Walsh, Ph.D.

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ABSTRACT:

Modeling of NO_x emissions from recovery boilers remains a challenging but important task since the emissions are usually regulated. Several simplified mechanisms for NO_x have been developed that can be readily incorporated using CFD models. These include an oxidation step for gaseous NH_3 to form NO and a parallel reduction step where NO is reduced by NH_3 to N_2. A previous study showed that using one set of oxidation and reduction equations for a flame region and a different set for the post-flame region was able to reproduce experimental rates for a nitrogen-seeded-methane-diffusion flame [1].

The use of the flame-based NO_x model in CFD predictions in recovery boilers gave results that matched stack testing or on-line measurements. This included predicting:

- reproducing NO_x emission measurements,
- the effect of increased liquor nitrogen on increased NO_x,
- the effect of increased excess air on increased NO_x,
- and, the ability of combustion air staging to reduce NO_x emissions.

The flexibility and robustness of the flame-based model was demonstrated by simultaneously solving for fuel NO_x and SNCR in a boiler.

Future NO_x modeling would benefit from a better understanding of the formation of NO_x precursors during black liquor volatilization and combustion, as well as parameters defining the flame region in the flame-based approach for modeling of NO_x.