TITLE: Heterogeneous Reburning by Mixed Fuels

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ABSTRACT

Pilot- and full-scale research has demonstrated a floor, about 60%, in either gas or coal reburning, below that NO cannot be reduced further. During natural *gas* reburning, a significant portion of the reaction intermediates, mainly HCN, oxidizes to NO in the burnout zone. During *coal* reburning, a significant portion of the char nitrogen oxidizes to NO in the burnout zone. Therefore, to break these limitations, future development has to focus on means to simultaneously minimize NO, HCN and char loading.

Mechanistic research at The University of Mississippi has revealed that the lignite chars possess dual catalytic efficacies that are capable of reducing NO and HCN simultaneously in reburning. This finding implies that lignite ash will be capable of breaking the NO reduction floor observed in gas reburning by a mixed fuel containing natural gas and a small amount of lignite char or ash. Mechanistic study at The University of Mississippi also revealed that catalytic oxidation of lignite chars results in the production of CO; CO, in turn, effectively removes surface oxides in the formation of CO_2. Desorption of surface oxides is generally considered a rate limiting step for NO reduction on char surface. The scavenging role of CO suggests that the production of CO has to be ensured before effective NO reduction by char. Thus, the dual catalytic role of char and ash can be fully utilized in practice when it is fed aft of the natural gas in reburning.

The proposed program in Phase I is designed to investigate the full potential of using a mixed fuel in reburning. We will collect bottom and fly ashes from lignite-fired power plants and evaluate their catalytic activities in a simulated flow reactor. We will also examine the catalytic efficacies of chars of various carbon burnout levels in mixed-fuel systems. The variables to be investigated in these tasks include reburning stoichiometry, quantities of the solid fuel, carbon content of the solid fuel, and the origin and history of the solid fuel.

The Red Hills Power Plant of the Tractebel Electricity and Gas International in Ackerman, Mississippi has agreed to offer technical advises and their utility prospective during the project. During

the course of Phase-I study, The University of Mississippi, Tractebel and the key players of coal reburning will continue to discuss the mixed-fuel concept and work with the most appropriate utility or pilot-scale research facility for demonstration runs in Phase II.

The use of mixed fuel is expected to substantially exceed the previously observed floor of the ultimate NO yield from the burnout zone. Specifically, the results from the project are expected to reduce the ultimate NO emissions to below 0.15 lb/Mbtu by heterogeneous reburning. Alternatively, it will be utilized in conjunction with other low cost NO reduction technologies such as SNCR to achieve this objective while significantly reducing the overall cost of compliance when compared to SCR. Minimal usage of lignite char will result in minimal productions of NO and unburned hydrocarbon in the burnout zone. It is also anticipated that the results generated from this program will open a new market for the ashes from lignite-fired power plants; alternatively, it is likely to revitalize the char production industry.