Investigation of mercury behaviour in the flue gas cleaning path of a lab scale firing system

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Mercury (Hg) is a highly toxic pollutant which has long-range transport in the atmosphere and long persistence in the environment. This characteristics cause the increase of attention on mercury removal as a pollutant of global concern in the last few years. The combustion of fossil fuels accounts for a significant share of total anthropogenic mercury emissions. Different studies showed that mercury can be removed from the flue gas by the use of air pollution control devices (APCDs) installed for the reduction of particulate matters (PM), NOx and SO2 emissions. Within several research projects, coordinated by the IFK, emphasis was laid on enhanced synergies of APCDs in terms of Hg-removal. At high gas temperature, elemental mercury (Hg0) is the dominant form based on the thermodynamic equilibrium and is hardly removable by the conventional flue gas cleaning systems. It can be oxidised in the presence of hydrogen halides either homogeneously in the flue gas path or heterogeneously at the SCR catalysts which are the state of the art technology for the NOx reduction in coal fired power plants. As oxidised mercury (Hg2+) is highly water soluble, it can be removed in wet flue gas desulphurisation (FGD) downstream of the catalyst. However, absorption of Hg-compounds in the scrubber is just the first step of Hg-capture by wet FGD. Under unfavourable FGD operational conditions, subsequent reactions in the liquid phase may cause the reduction of dissolved Hg2+-compounds to Hg0, which leads to lower Hg-removal rate due to undesired re-emission phenomena. Thus, parameters leading to stable dissolved Hg-compounds are beneficial for improved retention of Hg in wet FGD plants. Within the proposed paper, experimental results of a continuously operated lab-scale firing system equipped with a SCR catalyst, ESP and wet limestone FGD are presented, revealing the impact of operating parameters of the plant on the emission of Hg-compounds. The presentation gives an overview on the detailed behaviour of Hg in the flue gas cleaning path and provides conclusions for the optimisation of Hg-removal in fossil fuel fired power plants equipped with wet FGD.