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Case Study: NOx Reduction from Waste Steam

Background

A natural gas fired catalyst activator at a plastic plant in Belgium was subjected to upcoming stringent NOx emissions. The existing burner was unable to meet the new targets. Instead of hardware modifications or backend cleanup, STEP recommended to utilize the abundant steam that was available on site to reduce NOx emissions with **Steam Injection**.

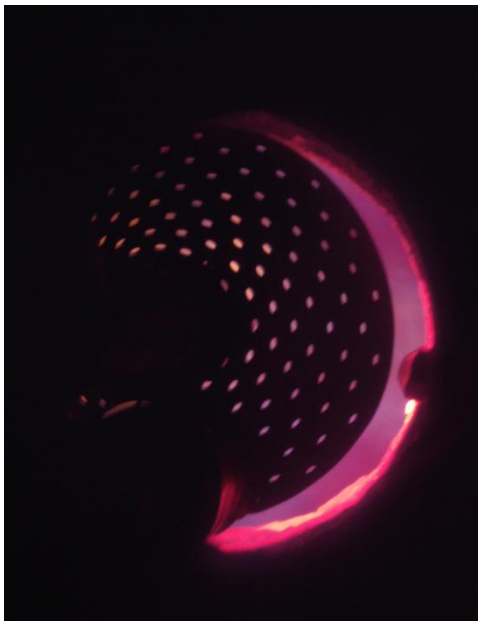
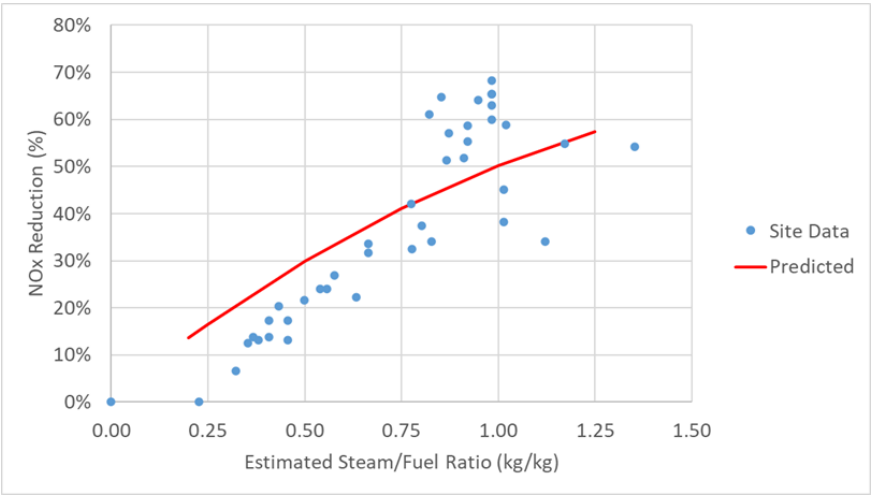


Figure 1: Steam Injection Nozzle in Burner Throat

Solution

For clients that have an excess of steam of waste steam, instead of being wasted, the steam can be utilized to reduce NOx emissions and avoid the capital expense of burner retrofits or the operation cost of Flue Gas Recirculation (FGR) or Selective Non-Catalytic Reduction (SNCR). Steam injection works similarly to FGR whereby steam is injected into the combustion air steam in order to dilute the mixture and reduce the bulk flame temperature. Steam can also be injected directly into the fuel steam, and there are pros and cons to either option, but in this case, injection into the air was the best option. A steam lance was built and inserted into an existing extra site port. Steam was brought to the burners with flex hoses and a temporary injection skid was built with isolation valves, a drain, and a pressure gauge for monitoring.

NOx was reduced by up to 69% with steam injection with no impact to CO or flame stability. In fact, with this older burner technology, the steam injection appeared to increase mixing in the burner throat and actually improved combustion. The initial flame was bright but dark orange. Above a 0.3 steam to fuel mass ratio, the flamed became a solid, blue, translucent flame. The UV signal on the flame scanner increased significantly, nearly doubling.



Conclusion

STEP Combustion successfully utilized waste steam to reduce NOx emissions by up to 69% with no impact on CO or stability in a catalyst activator burner. Upon success of the trial, the plant moved forward with a permanent system.