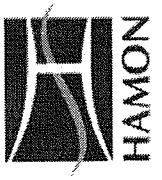

HAMON RESEARCH-COTTRELL, INC.

Maintenance Recommendations for Hamon R-C's Lime Semi-Dry FGD Technology

Based on HRC's extensive installed base of wet and dry Flue Gas Desulfurization systems, the process and operating conditions encountered by the emissions control system installed on a heat recovery coke facility are very a-typical of those experienced at other applications such as conventional coal fired boilers. Coke oven facilities of this type exhibit very unique and challenging operating conditions which require extra O&M considerations that typically are not present on other lime semi-dry FGD applications. In particular, the DFGD equipment faces significant variances in cyclic load conditions on a 24/7/365 basis with wide swings in gas temperatures and flow rates and acid gas concentration levels. The presence of SO_3 and HCl acid gases at higher levels then existing in normal coal fired boiler applications requires special attention with respect to monitoring of equipment for corrosion and undesirable by-product build-up and deposits.

HRC's as well as general industry experience has shown that DFGD installations which are treating high levels of HCl in the gas stream exhibit a tendency for enhanced internal corrosion problems and also reaction by-product dropout and deposits. Dropout material which takes place during fluctuating load operation will be especially problematic because of the hygroscopic nature of the calcium chloride – $CaCl_2$ – reaction by-product which is formed. Unlike conventional coal fired DFGD installations where coal fly ash dropout is light and easily re-entrained at design gas flow velocity, this $CaCl_2$ material readily creates sticky and hardened deposits which are not re-entrained in the gas stream. Over time, build-up of deposits can alter the ductwork gas flow distribution exacerbating the dropout problem and eventually restricting the internal ductwork gas flow which will lead to other operating problems, including reductions in SO_2 removal efficiency.

Lime semi-dry FGD systems are designed for routine maintenance of critical operating components while the flue gas production process remains on-line; i.e. rotary atomizers can be exchanged on line; filter bags and cages can be inspected and replaced when necessary, and external components such as hopper heaters, level detectors, filter bag cleaning systems, control instrumentation can all be inspected and replaced during normal operation. However, critical system components such as dampers, flow distribution devices along with internal corrosion and by-product dropout and deposits can only be determined by performing an internal inspection when the complete FGD system is removed from service.

For a coal fired power plant DFGD installation, this internal inspection is typically conducted on a yearly basis during annual plant outages. However, in between these annual outages, quick inspections are often performed during unexpected plant forced outages, particularly if known problems exist within an operating system. And, in the event that a major malfunction occurs, the complete power generation system can be temporarily shut down to facilitate emergency inspections and repairs to the DFGD equipment. Over the past twenty-five (25) plus years of DFGD system operation, these basic procedures have been acceptable for the much less difficult coal fired applications.

Recognizing the extremely challenging service encountered by the DFGD system on coke oven emissions treatment, HRC endorses a very aggressive preventative maintenance program for its DFGD equipment. This preventative maintenance program should be geared to producing optimum performance over the entire operating year in order to maximize the effective service life of all components. HRC's recommendations for this application include semi-annual and annual complete internal inspections. The semi-annual outage should encompass a minimum of one (1) or two (2) days to confirm proper operation, resolve minor operating issues, and develop service plans for the annual outage time. The annual outage would likely encompass two (2) to five (5) days to perform a thorough internal inspection and complete maintenance work identified earlier or at the time of the outage.

HRC views these planned outage events as realistic and necessary preventative maintenance procedures specific to this unique application which will maximum the overall reliable operation and emissions performance of the DFGD system throughout its long service life.

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