Title: SCR Cleanliness

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General: With recent changes in the regulatory environment surrounding the reduction of NOx emissions in the United States interest in the various methods of achieving this reduction are being accelerated. While this market has a great deal of knowledge and experience in methods such as low NOx burner retrofits. Areas such as SNCR and SCR are relatively new to the North American power producer.

With the exemplary models being set by plants such as PSNH's Merrimack Station where SCR retrofits are providing NOx level reductions not only in line with the EPA standards for coal fired plants but going beyond and actually having emission levels below the EPA standards set for gas fired power producers interest in the SCR is being accelerated rapidly.

Examination of models such as this in addition to the mature SCR installations in Europe and Japan provide us with an experience model to work with. While there are many considerations when installing a SCR maintaining an acceptable cleanliness level during operation is at the forefront and is the topic of this paper.

Importance: Proper cleanliness of the catalyst surface is critical to not only maximum reactor efficiency but can have a significant impact on overall plant performance if plugged. On line SCR cleaning is a difficult and scientific balance between constantly maintaining clean catalyst surfaces and taking care to not over-clean and erode the typically sensitive ceramic or ceramic coated surfaces within the reactor bricks.

Methods of on-line SCR cleaning: Currently SCR manufacturers and end users have two basic technologies to choose from, the first being Sonic cleaning. While this technology has proven useful in many applications such as bag houses where cleaning of a consistently dry, powdery deposit is required data on successful applications in an SCR application are difficult to find and record. The second and most widely accepted method of cleaning involves the introduction of a cleaning medium across the reactors through the use of a retractable sootblower which has been substantially modified to achieve the balance between proper and over-cleaning noted above.

While the prevalent choice remains the modified sootblower several variations and subsequently choices remain within this category. While there are many distinctions between the equipment manufacturers several basic facets of the equipment design stand out as noteworthy when making a selection. Most basic of which is the drive mechanism with a choice between 1.) chain drive, 2.) Offset rack and pinion drive and 3.) Modular, balanced rack and pinion drive being available.

On-line, retractable SCR cleaner description: As mentioned the SCR cleaner is a modified retractable sootblower with the primary modification being the typical sootblower lance is replaced by a "rake" arm which consists of a main longitudinal lance with several lateral rake arms attached perpendicular to the main lance with threaded fittings. Of particular importance in the rake arm design is the incorporation of a "preheat loop" which preheats the blowing medium resulting in the purge of potentially damaging condensate. The rake arm assembly is designed to retract over the catalyst module at specific intervals and traversing speeds ranging from 20" to 80" per minute, delivering a cleaning medium designed to maximize cleanliness and minimize erosion of the catalyst surface.

On-line, retractable SCR cleaner design criteria: The optimal retractable SCR cleaner is designed to use high temperature, superheated steam, typically 650 F as a cleaning medium. This requirement provides a substantial increase in reactor life in two ways. First the amount of moisture or condensate is minimized thereby minimizing impingement on the sensitive surfaces and secondly the superheated steam minimizes the thermal shock on these surfaces which are typically in the area of 800 F. The rake arm assembly is constructed with small, typically 5/16", cleaning nozzles totaling 120/130, specifically designed to maintain a cleaning velocity of approximately 20 meters per second. The exit area of the nozzle should be maintained at a minimum of 20" from the catalyst surface and the total flow is designed to supply approximately 25,000 pph . The most significant consideration when designing the rake arm assembly is the pitch of the SCR unit with smaller pitches being more susceptible to pluggage through an accumulation of contaminants in the flue gas stream.

Optimum design features: over 80% of the global SCR applications have selected the Clyde Bergemann, Inc. SCR cleaner for not only its ability to meet the above design criteria which has proven to provide maximum cleaning with minimum erosion but also for the added benefit of lower maintenance expenses over time. These substantial maintenance reductions are attributed to the unique 1.) Balanced drive mechanism in which the traveling transmission, attached to the longitudinal lance, is placed in the center of the cleaner itself. While this feature is arguably beneficial in traditional sootblowers its importance is magnified by the increased weight and load width of the complex rake arm assembly. With other "offset" drive mechanisms this increase in load weight and distribution amplifies the wear on drive components due to the uneven distribution of force. 2.) Modular transmission design in which thermal transfer from the superheated steam to the transmission gearing is minimized through a separate upper and lower gear case assembly with the lower gear case assembly housing the feedtube and lance spindle which is subjected to the high temperature steam and the upper gear case which contains the transmission gearing now protected from the detrimental affects of the high temperature cleaning medium below.

Summary: Considering the high cost and critical nature of the SCR retrofit selection of an efficient, dependable on-line cleaning system is extremely important and consideration must be given to 1.) system's proven ability to clean effectively. 2.) system's proven ability to prevent damage to catalyst surfaces. 3.) system's proven ability to maintain a high degree of dependability and reliability with minimal maintenance.