Installation and Start-up of the First Large Scale AOD™ Process on two 1,300 MW Coal-Fired Midwest Utility Boilers

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Summary:

Recent Federal EPA regulations require power plants to plan for substantial reductions in their emissions of nitrogen oxides (NO_x). The most widely used technology for high efficiency reduction of NO_x is Selective Catalytic Reduction (SCR) using ammonia as the reducing agent. To achieve high levels of NO_x reduction in a large coal-fired power plant, ammonia consumption of several thousands of pounds per hour is typical. There are two traditional forms of ammonia used for this purpose; anhydrous and aqueous ammonia. The potential for an accidental release of a large quantity of anhydrous ammonia poses a safety risk to plant workers and the surrounding communities. Moreover, the use of anhydrous ammonia is heavily regulated by both OSHA and EPA, and compliance with these regulations may require additional plant staff or the use of outside consultants. The use of aqueous ammonia requires the transportation and storage of much larger quantities of diluted reagent and adds operating cost in the form of energy to evaporate the water of solution.

Ammonia On Demand (AOD™), an alternative to the use of anhydrous or aqueous ammonia, has been developed and implemented over the past year. Environmental Elements Corporation (EEC) has obtained a license to technology jointly owned by SiirTec Nigi of Milan, Italy and HERA LLC of Lake Forest, CA for the production of ammonia from solid urea. The AOD™ process was first installed at the Canal Station of Mirant Corporation in Massachusetts and operated successfully during the summer of 2000. Rather than transport and store anhydrous or aqueous ammonia, this site trucks in solid urea and stores the benign chemical in silos on site.

The AOD™ process begins with solid urea granules or prill, and creates a solution by dissolving the urea in recycled solution. This solution is then pumped through an economizer to the hydrolyzer. In the hydrolyzer, the solution is heated to reaction temperature and the urea reacts with water to form ammonia and carbon dioxide. Steam is fed into the bottom of the hydrolyzer to strip the dissolved ammonia from solution and transport it to the ammonia injection grid of the SCR. The ammonia stream may be diluted with warm air to reduce the concentration to 5% or less as desired by the SCR manufacturer. The entire process is automatically controlled to respond rapidly to changes in demand from the SCR control system.

This technology has recently been applied to two 1,300 MW coal fired located in Cheshire, Ohio. The boilers will have a total of six SCRs on both units. The system was originally planned to use anhydrous ammonia, but was changed to a urea-based ammonia system in response to concerns expressed by the local townspeople. The order for an AOD™ system to supply both boilers was given to EEC in December, 2000, and delivery of the process equipment was completed in April. The system was placed into commercial operation in May. The design capacity is 7,000 lbs/hr of ammonia.

The AOD™ system was started up without serious complications, and has entered the testing phase to prove performance prior to acceptance. Preliminary results indicate it is operating smoothly and producing the required levels of ammonia. Utility consumption is as predicted, and response time is more than adequate to match changes in boiler load.

The major advantage of the AOD™ process is its ability to produce ammonia on site at reasonable cost and in response to the demands of the plant without the necessity of storing or handling hazardous materials, creating a safer environment for plant staff and the local community.