

ADA-249 Improves Cyclone Boiler Operation with PRB Coal

Cyclone boilers, which were built in the 50s and 60s, are an efficient, compact way to burn high-ash, high-sulfur coals to produce steam for power generation. The design coals produce a thick molten slag layer on the walls of each cyclone barrel. The slag coating catches the incoming coal and holds it until combustion is completed. When burning Powder River Basin (PRB) coal, however, the slag layer is too thin and watery to capture the coal, so the coal must burn in flight. Even though PRB coal burns faster than bituminous coal, there is just not enough time for combustion to be completed within the main furnace fire-box. The result is usually unacceptable amounts of unburned carbon in the flyash (fires in the ash collection system have occurred at some plants) as well as increased ash deposition, higher stack opacity, and reduced unit heat rate.

Another problem with PRB coal slag in a cyclone furnace is that it solidifies (freezes) abruptly during low-load operation when the cyclone temperature drops. Since these boilers rely on keeping the slag molten all the way to the slag tap (a drain on the furnace floor) in order to operate, the freezing problem can cause unplanned shutdowns and lost revenues. In order to keep the PRB molten, these units must be operated at high loads even during periods of low demand which adversely effects power revenues.

Finally, bottom ash is a more valuable commodity for sale to ash brokers than flyash. Many cyclone boilers that have converted to PRB coal have lost significant revenues from ash sales compared to the old days of burning high-ash coals.

Steve Johnson, ADA-ES' Vice President of Eastern Operations, has worked on cyclone boilers since his days with Babcock & Wilcox in the early 80s. His experience over the years led to the belief that cyclone boilers could operate better on PRB coal if operators had a way to make the PRB slag behave more like bituminous coal slag.

The product that we came up with to modify slag viscosity is called ADA-249. It is a patent-pending blend of iron oxides, mineralizers, and flow enhancers that is added to the PRB coal prior to combustion in order to create the proper slag layer for combustion within the cyclone barrel.

The first demonstration of ADA-249 is now taking place at Kansas City Board of Public Utilities, Quindaro #1, a 75 MW unit in Kansas. A pneumatic storage and injection system has been installed at the site, and boiler performance data have been obtained since April of this year. The changes in boiler operation have been dramatic:

- Operators have been able to run the boiler as low as 47% of capacity. Without ADA-249, operation was limited to a minimum load of 75% due to slag tapping problems.
- This load flexibility will save the plant about \$200,000/yr., not counting the expected increase in unit availability from fewer shutdowns to clean the slag tap.
- A high-temperature video camera also shows that the main furnace is clear when injecting ADA-249 (meaning that the coal stays in the cyclone to burn) instead of hazy due to unburned fuel when no additive is injected.
- The plant confirms that flyash LOI is low and bottom ash is acceptable for high-value sale when the ADA-249 is used.

Not all cyclone boilers and PRB coals are alike. Call John Wurster to arrange for an evaluation of how ADA-249 can work in your cyclone boiler.

3rd Generation Chemical Cures Sodium Depletion in Hot-Side ESPs

May 2000 marked the first full year of continuous use of ADA-ES' 3rd generation chemical ADA-37. Two 500 MW units began using this improved product on a trial basis after their Spring 1999 outages. After struggling for years with hot-side ESP sodium depletion problems that forced many outages, both units were able to operate the entire year without an ESP cleaning outage and associated costs and lost generation.

Based upon the success of this product, both utilities committed to permanent injection systems in February. The new equipment included an injection skid with new PLC controls, shield air blowers, and lances. The permanent components are designed to greatly reduce maintenance requirements over the trial systems.

ADA-37 is currently being used to condition four hot-side ESPs representing 2400 MWs of generating capacity. Since installing the ADA-ES systems, users report increased capacity and less ESP maintenance. In addition, all four units continue to sell the conditioned ash for use in concrete.

Eastern Bituminous Coals Next Target

Our four current applications are on ESPs collecting problematic ash from PRB coals. Before conditioning, these units typically had to derate the boiler to meet emission limits and often shut down several times a year to clean the ESP. Utilities with hot-side ESPs that burn Eastern Bituminous coals have their own set of problems, often requiring sodium addition to provide temporary relief. As with PRB coals, sodium addition to the coal can lead to a variety of boiler-related problems (e.g., slagging, high temperature).

Laboratory experiments have been conducted to determine how various ADA-ES conditioning agents perform with ash from Eastern Bituminous coals. Results are very promising in that the ashes are very responsive to the conditioning and particle resistivity can be reduced to the optimum range with significantly less chemical than that required for PRB ashes. This could reduce the cost of the chemical by a factor of two for these applications. We are very confident that these products will provide cost-effective solutions for hot-side ESP problems on a variety of coals. We are willing to work with utilities in a "try before you buy" arrangement so that the user can evaluate the cost and performance benefits of the ADA-ES flue gas conditioning technology with minimal risk.

Customer Specific Product Development

The ADA-ES product development group continues to work on new chemical formulas to meet the special needs of its customers. A growing number of customers have requested a chemical that can be used on hot-side ESPs during the Spring and Fall "shoulder seasons" when utilities often have to operate at very low loads for extended periods. These low-load, low-temperature conditions produce resistivities often ten times higher than that at full load and can often restrict how quickly boiler load can be increased.

Our 4th generation chemical, ADA-43, was specifically designed for these conditions. Laboratory tests show that ADA-43 can produce lower resistivities in the 400-600°F-temperature range typical of low-load operation. We hope to demonstrate this new product this Fall at one of our current sites.

Products for Refinery FCCU ESPs

In addition to coal-fired boilers, another exciting market for the ADA-ES conditioning system is the application at petroleum refineries. Currently refineries inject ammonia to improve the collection of catalyst fines in an ESP. The release of the injected ammonia is a major component of the total air emissions reported by refineries in the EPA Toxic Release Inventory.

Our R&D group has developed and tested a new product that can reduce the resistivity of catalyst fines and can operate in the FCCU environment. The product was tested for over a month at a refinery with no adverse effects. These tests confirmed that, as with our utility applications, the product must be used immediately after the ESP has been cleaned during an outage. Under these conditions, the product provides continuous long-term operation of hot-side ESPs without degradation.

Currently, we are in the process of identifying refineries that will have turn-arounds in the near future. The benefits to the refinery of switching to ADA-ES Flue Gas Conditioning are significant:

- Elimination of ammonia slip;
- Reduction of the largest reportable air emission;
- Removal from lists of “highest polluters”; and
- Favorable publicity from using the latest emission control technology.

New Solutions for Old ESPs

We are now in full swing on our DOE program to develop new flue gas conditioning (FGC) technologies that improve performance of older, smaller ESPs. Laboratory testing will be completed soon and we anticipate that the new products will be ready for initial field evaluation in the fall.

These full-scale field evaluations provide a rare opportunity for ESP users that must reduce emissions, to evaluate options at their site for minimal cost. DOE funding will pay for much of the demonstration and there are no obligations once the demonstration is completed. Sites of interest include ESPs that have Specific Collection Area (SCA) less than 300 ft²/kacfm with resistivity and reentrainment problems. Testing could start as early as August. Contact Jean Bustard or John Wurster for information at (303) 734-1727 or jeanb@adaes.com, johnw@adaes.com.

New Information Resource for Hg Control

By December 15, 2000 the Environmental Protection Agency must decide whether mercury emissions from coal-fired utility boilers will be regulated. Coal-fired electric generators are being targeted because they currently represent the largest single source of anthropogenic mercury emissions in the U.S.

In anticipation of potential regulations, a great deal of research has been conducted during the past decade to characterize the emission and control of mercury compounds from the combustion of coal. This research has demonstrated that control of mercury from utility boilers will be both difficult and expensive (it is estimated that 90% mercury reduction for utilities could cost as much as \$25,000 to \$70,000 per pound of mercury removed adding anywhere from cents to dollars per MWh in compliance costs).

ADA-ES will use its website at www.adaes.com to disseminate the latest information on mercury emissions and control along with our capabilities. This site will include technical documents as well as reports from environmental groups. We will also provide links to key sites such as the EPA ICR database on mercury emission test reports. For further information go to the Mercury header at this site or contact Dr. Michael Durham at miked@adaes.com.

Mike Durham Slides into His Second Half Century

Mike Durham celebrated his 50th birthday fulfilling a dream of helicopter snowboarding in the Canadian Rockies. Helicopter skiing is a sport that reportedly requires “an income of a 50 year-old and a body of a 20 year-old”. To overcome the obvious physical limitations, Mike spent three months cycling and weight training to get ready for the trip. The conditioning paid off as he set the record for the lodge that week by covering over 152,000 vertical feet of steep mountainous terrain in 5½ days. He took one day off in the middle of the week when the helicopter rotors were icing over (actually, a full day of alcohol and Cuban cigars in the hot tub was already on his agenda).

The experience was both beautiful and thrilling, “we’d fly to the top of one mountain, land on a narrow ridge, and then make our way down untracked deep powder to a pick up spot at the bottom, and then fly off to a completely new mountain”. Part of the thrill came from surviving a couple of mishaps including a 15-ft head first fall over a hidden cornice and struggling to climb out of a tree-well with snow several feet over his head. The adventure has created a dilemma for Mike; having convinced his wife this trip was a once-in-a-lifetime experience. How does he persuade her to let him go again next year? After all, turning 51 is a key milestone in ones life.

ADA-ES Organized and Hosted EPRI Baghouse Workshop

On Thursday, May 18 ADA-ES hosted a baghouse workshop sponsored by EPRI that presented results from EPRI research efforts to its members and contributing manufactures. The objectives of the invitation-only workshop were to highlight EPRI research and development efforts in baghouses, discuss the current state-of-the technology and future R&D needs, and to thank the many participants who assisted EPRI in the advancement of fabric filtration technology. The workshop was well attended by baghouse users, research contractors, and suppliers of fibers, fabrics, bags, and cages to the utility industry. Timely discussions included status of bag development and the role of baghouses to met future regulations in a deregulated industry.

ADA-ES Ms. Jean Bustard organized the technical program for EPRI and presented results from full-scale bag evaluations at TXU's Big Brown Station. Ms. Bustard has over 17 hears of experience in baghouse research, development and evaluation. Look for her next presentation at Reinhold Environmental's ESP/FF Round Table and Expo Conference in Charlotte, NC on July 31.