

**Title:** Reducing Unburned Carbon in Flyash from Cyclone Boilers

**Authors:**

Stephen A. Johnson and John P. Comer  
ADA-ES (an Earth Sciences Company)  
50 Nashua Road, Suite 112  
Londonderry NH 03053.  
Stevej.adaes@verizon.net  
(603) 425-6765 phone  
(603) 425-6262 fax

John Meinders  
Kansas City Board of Public Utilities  
Quindaro Power Station  
3601 North 12<sup>th</sup> Street  
Kansas City, Kansas 66104

**Summary:**

Cyclone boilers are an efficient, compact way to burn high-ash, high-sulfur coals to produce steam for power generation. The original coals produce a thick molten slag layer on the walls of each cyclone barrel. The slag coating catches the incoming crushed coal and holds it until combustion is completed. When burning Powder River Basin (PRB) coal, however, the slag layer is too thin to capture the coal, so it must burn in flight. LOI results because there is just not enough time for combustion to be completed within the main furnace firebox. The problem becomes even more acute under low-NO<sub>x</sub> firing conditions.

ADA-ES has tested an iron-based blended material (called ADA-249) that modifies the viscosity of the slag coating on cyclone walls so that more coal is captured and burned. This paper will discuss results from KCBPU, Quindaro Unit #1, and show the effects of ADA-249 on flyash LOI, bottom ash production, NO<sub>x</sub>, furnace temperature, and slag tap performance at this 75-MW (net) unit. Key points include:

- At dosage rates less than 1 % of the coal flow, ADA-249 allowed the plant to extend low-load operation from 60 MW down to 35 MW, and thus achieve better economic dispatch for their electricity generation.
- With the additive, bottom ash slag is heavier and denser, making it acceptable to ash brokers for use as grit for sand blasting or roofing shingles.
- An increase in bottom ash production was apparent, but tests were not performed long enough to quantify this result (the unit was shut down from July 2000 to March 2001 due to major repairs unrelated to our system).

- Carbon content of the flyash is nominally 5 to 15 percent without benefit of ADA-249 injection at 3.5% flue gas O<sub>2</sub>. Though not extreme, this amount of flyash carbon compares to <1% on Quindaro's pulverized coal-fired unit.
- Our goal is to keep unburned carbon in the flyash in the range of 5% at 2.5% O<sub>2</sub>.
- This goal will be addressed during precipitator performance tests scheduled for April of 2001. Results from these tests will be reported during the oral presentation.