Airflow Sciences Corporation

Optimizing SCR Performance

Case Study

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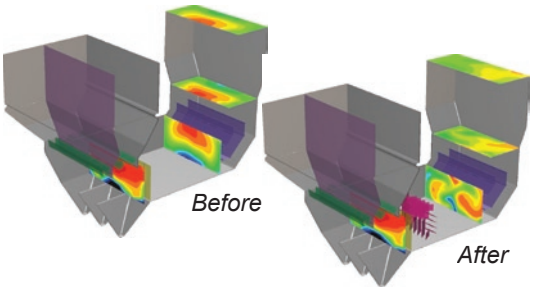
Color Contours Illustrate NOx Concentration



CFD model of the boiler exit region. Uniformity of NOx was achieved with the installation of a static mixer.

Physical Model of the Big Bend Unit 3 SCR

In Spring 2008, Tampa Electric's Big Bend Unit 3 SCR became operational. Airflow Sciences performed modeling to design flow devices that optimize SCR performance. Others involved in the SCR system design included: Cormetech (catalyst supplier), Sargent & Lundy (AE), Sulzer (AIG/mixer supplier), and Tampa Electric. This SCR was particularly complex from a fluid dynamic view, with the following performance goals:

- Provide a uniform ammonia-to-NOx ratio at the catalyst, despite the fact that NOx stratification at the boiler exit was severe.
- Achieve minimum system ΔP to save operational costs and capital for new fans.
- Generate a uniform velocity profile at the catalyst to promote maximum NOx reduction.
- Since Big Bend Unit 3 is a coal fired plant, avoid areas where coal flyash will settle out in the duct work when operating at reduced loads.

To meet these goals, a 1:12 scale physical flow model was fabricated and used to design the SCR system. A CFD model was also used for a portion of the design. To mix the highly stratified NOx, ASC designed a custom mixer located in each boiler exit duct. This provided reasonably uniform NOx in the location of the ammonia injection nozzles. Two static mixers, designed by Sulzer, promoted mixing of the injected ammonia such that the stoichiometric ratio of ammonia and NOx at the catalyst inlet was within the uniformity goal of 5% RMS. ASC's optimization, performed with the physical model, generated a final design that was robust despite the non-uniform boiler exit flows.

When the system started up in Spring 2008, Cormetech's emissions measurements indicated close correlation to model results. Particularly, the measured ammonia distribution at the catalyst inlet closely matched the model's profile.

Unit 3 is the second SCR to operate at Big Bend. Unit 4, also modeled by ASC and designed by the same team, started up successfully in Spring of 2007. Construction of the Unit 1 & 2 SCRs, using the same design for flow control devices, is underway. ASC was pleased to be part of such an important project for Tampa Electric and all the design participants.