Airflow Sciences Corporation

Temperature Mixing Solutions

Case Study

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Document A-48

Tampa Electric Company recently contracted Airflow Sciences Corporation (ASC) to help optimize flows at the Big Bend Power Station as part of an upgrade of their electrostatic precipitator (ESP). The goal was to minimize the potential for corrosion of the new ash collection elements. Plant test data showed that the gas temperature entering the ESP varied by almost 70ºF. This thermal gradient resulted in “cold zones” within the ESP where metal corrosion could be more prominent.

To correct the situation, ASC constructed a computational fluid dynamics (CFD) model of the ESP inlet ductwork system. The modeling goals were to assess the current temperature patterns and design a flow mixing device that reduced the temperature stratification.

The duct geometry is shown in the figure. The flow exits the rotary air heater and splits to four separate ESP chambers (pink). Rotary air heaters typically cause a temperature gradient, and at Big Bend it was severe. Field testing indicated that the temperature varies by 75ºF at the air heater outlet.

As the gas continues to the four ESPs, it does not mix much, due to the ductwork geometry and short residence time. The figure indicates the gas temperature profile at select planes within the duct. At the ESP inlet, the temperature variation is 68ºF.

The CFD model was then used to develop a customized thermal mixer. A unique arrangement of baffles was developed to blend the hottest and coldest zones. After installation at Big Bend Unit 2, the temperature gradient was reduced to 24ºF. The added pressure loss was 0.7 IWC, well within the plant-specified maximum of 2.5 IWC.

Tampa Electric personnel are very pleased with the results and now consider the corrosion problem resolved. A similar modeling effort is nearly complete for Unit 3. Further details can be found on ASC’s website, or by calling John Smolenski of Tampa Electric Company at 813-228-1452.