Airflow Sciences Corporation®

Particulate Emissions Reduction

Case Study

By Robert G. Mudry, P.E.
Airflow Sciences Corporation

(734) 525-0300
www.airflowsciences.com

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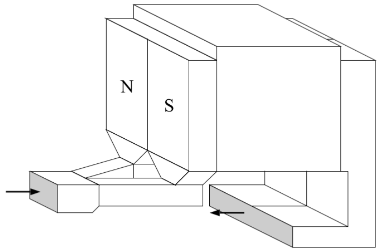

Figure 1 - ESP Geometry

	North ESP	South ESP	Industry Standard
RMS Deviation from Average Velocity [%]	36.2	27.8	<15.0
Percent over 115% of Avg. Velocity [%]	38.6	25.4	<15.0
Percent over 140% of Avg. Velocity [%]	10.0	8.0	<1.0

Figure 2 - Baseline velocity statistics at ESP inlet

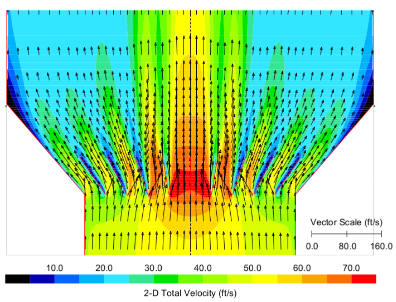

Figure 3 - Velocity profile in ESP inlet expansion

	North ESP	South ESP	Industry Standard
RMS Deviation from Average Velocity [%]	11.2	11.9	<15.0
Percent over 115% of Avg. Velocity [%]	8.2	8.4	<15.0
Percent over 140% of Avg. Velocity [%]	0.0	0.0	<1.0

Figure 4 - Final velocity statistics at ESP inlet

	Baseline	Final Design
Full Load Opacity	16-19%	Less than 10%
Opacity Spiking	serious concern	no concern
Unit Derates due to Opacity	~10 MW	none
ESP wash frequency	50-60 days	at least 176 days

Figure 5 - Before and after performance comparison

Particulate emissions is a serious issue at most industrial facilities. At many sites utilizing particle collection systems such as electrostatic precipitators (ESPs), baghouses, or multicyclones, it has been observed that the flow distribution through the collection system can have a major influence on performance. Airflow Sciences Corporation (ASC) has examined and improved the flow characteristics through numerous systems via field testing and computer flow modeling.

An electric utility customer in the Southeast United States teamed up with ASC to enhance operation of the ESP at one of their power stations. ESP performance was marginal, with opacity levels running between 16% and 19%. The station's opacity limit is 20%, so small opacity spikes can cause major problems. Running so close to the limit occasionally resulted in unit load restrictions due to opacity. In addition, the ESPs required washing every 50-60 days in order to maintain collection efficiency. This unit burns eastern bituminous coal and has a split hotside ESPs, denoted North and South, as shown in Figure 1.

Baseline velocity measurements, taken during cold-flow operation with a vane anemometer, indicated severely non-uniform flow at the ESP inlet. The measured velocity distribution fell significantly outside of current industry standards for flow uniformity, as shown in Figure 2.

To improve ESP collection efficiency, the customer requested a testing/modification program to improve flow uniformity at the ESP to within 10% deviation. The program involved an iterative process of modifying flow control devices (baffles, vanes, etc.) and measuring the subsequent ESP velocity profile.

ASC performed some initial flow modeling and noted that the velocity profile downstream of the expansion region was poor. The expansion was too abrupt, resulting in high velocities at the center and low velocities on each side, as shown in Figure 3. Modifications were focused in this region.

During the iterative balancing, 13 different design scenarios were evaluated. A final configuration of flow control baffles was developed which drastically improved the ESP flow distribution while minimizing both pressure loss and potential for flyash accumulation. Figure 4 reports the final flow field characteristics.

The unit came back on line after the fall outage with the final design modifications installed. ESP performance was observed through the next scheduled outage, in the spring. Over these 176 days of running, some dramatic performance improvements were noted, as shown in Figure 5.

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