Winter 2000

AIRFLOW SCIENCES CORPORATION

The Airflow Update

Improving Accuracy of Plant Emission Monitors

Major industrial facilities are required to continuously monitor plant emissions to the atmosphere. The continuous emissions monitoring systems (CEMs) in use today are highly sensitive to flow conditions in the vicinity of the monitor probes. If turbulent, swirling flow exists, measurement accuracy is degraded. For optimal accuracy, the flow passing the monitor should be unidirectional and uniform in profile.

At Gainesville Regional Utilities' Deerhaven Station, cyclonic flow in the chimney was an occassional issue under certain operating conditions. During these times, the plant had to modify their operating conditions to minimize this flow-related problem. GRU contracted Airflow Sciences Corporation to determine the root cause of the flow problem and develop a cost-effective design solution.

Airflow engineers utilized a computational fluid dynamics (CFD) flow model of the chimney and duct system in the analysis. This model provided a clear understanding of the flow profiles that set up the cyclonic, non-uniform flow. Model results are shown in Figure 1. At the monitor location, a highly non-uniform velocity distribution was present.

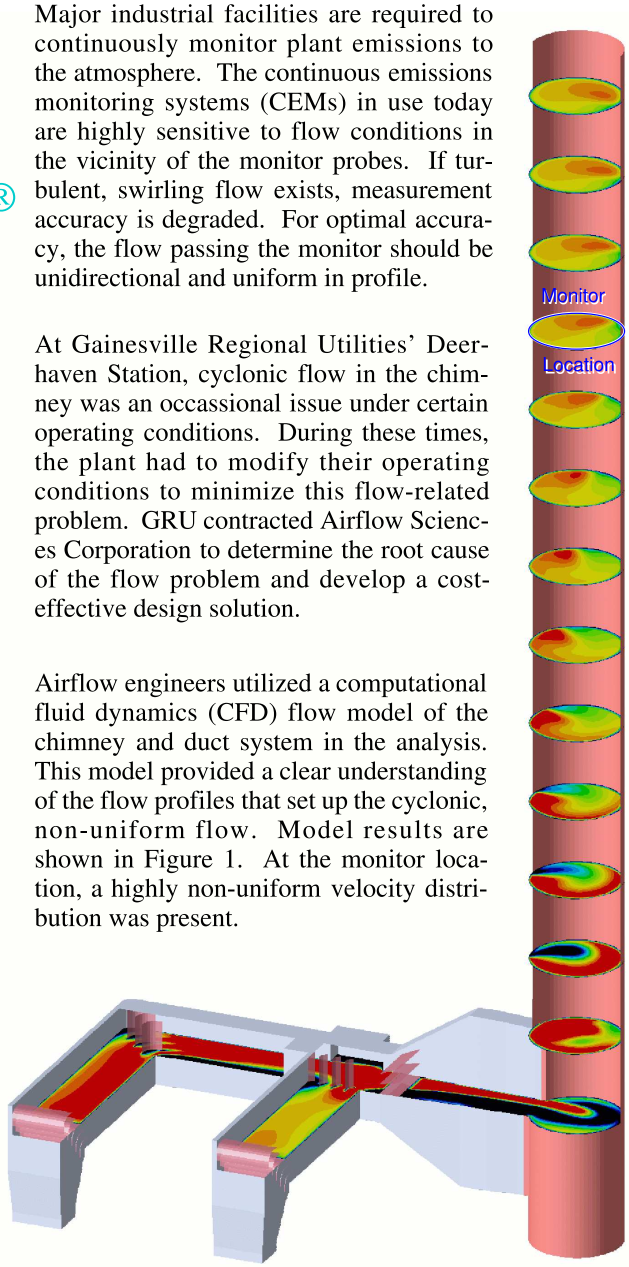

Figure 1. Baseline Model Results

The geometry of the chimney inlet ductwork did not allow the two incoming flow streams to join uniformly. The result was a biased velocity profile which sets up the corkscrewing, cyclonic flow in the chimney. Model results were confirmed via comparison to plant measurements (relative accuracy test audit, or RATA, data), shown in Figure 2.

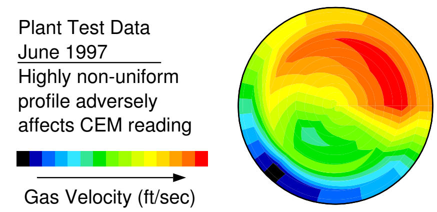

Figure 2. Baseline Velocity Profile at Monitor Location

The model was then used to evaluate a number of possible design changes to improve the flow. The final design, installed in the plant in March, 1999, reduced the cyclonic flow and significantly improved the velocity profile at the monitor position. Stack test data after installation is shown in Figure 3.

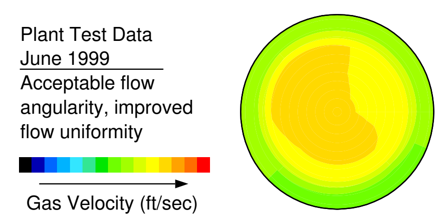

Figure 3. Post Installation Performance - Velocity Profile at Monitor Location

Since the installation, the plant has not experienced any issues with the CEMs accuracy or repeatability due to cyclonic flow.

The Inside Story

Rob Mudry, whom many readers of this newsletter know, recently became a one-third owner and director of Airflow Sciences along with Bob Gielow and Bob Nelson. Rob's commitment and leadership skills will help to ensure the company's continued growth and vitality. Welcome aboard, Rob.

Until June 1999, a non-compete clause prevented Airflow Sciences from undertaking automotive-related projects. We have now returned to the automotive and vehicle performance arena, most notably with recent projects in automobile and railroad HVAC systems. We are excited to work in this industry, and look forward to providing the same cost-effective engineering solutions that we do for power generation, food processing, sporting equipment, and other industries. If you have any flow, heat transfer, or mass transfer issues you're dealing with, feel free to give us a call at 734-464-8900.

Reducing Plant Emissions and Operating Costs

Recently, a southeast U.S. electric utility worked with Airflow Sciences to analyze its particle collection equipment. Their coal-fired power plant utilized an electrostatic precipitator (ESP) to collect flyash and minimize stack particulate emissions. The plant was seeking a cost-effective way to improve ash capture in the ESP in an effort to avoid additional capital expenditures.

Based on the system geometry, Airflow engineers suspected that gas flow problems may exist that limit ESP performance. To confirm this, ASC performed on-site testing to measure the flow patterns within the ESP. The testing revealed that improvements were possible, so a flow model of the ESP was created. This model was then used to simulate the flow within the ESP and to develop an improved design.

The baseline flow model, representing current operating conditions, indicated sub-optimal gas flow profiles, as shown in Figure 4.

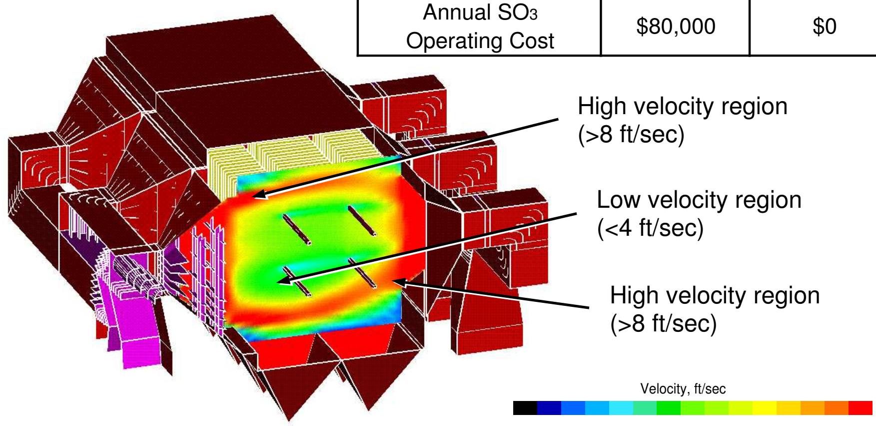

Figure 4. Baseline ESP Flow Patterns

To improve the flow characteristics, Airflow Sciences teamed up with Stothert Engineering, Ltd. of Vancouver. Stothert offers *Skewed Gas Flow Technology*™ to improve ESP performance. This concept differs from the industry standard, which targets perfectly uniform velocities within the ESP.

Stothert's engineers define a customized gas flow pattern within the ESP to optimize collection efficiency. Generally, the velocity pattern is "skewed" such that higher velocities exist in certain regions and lower velocities elsewhere. Stothert experience has shown that skewed profiles result in improved performance over uniform profiles. For further information, contact Rick Higginson of Stothert at 604-681-8165.

ESP Performance
Before and After Modifications

	Before	After
Opacity	18%	7%
SO_3 Injection	8 ppm	none
Annual SO_3 Operating Cost	$80,000	$0

ASC engineers used the flow model to develop the necessary flow control devices to achieve Stothert's recommended skewed velocity profiles. These flow control devices included turning vanes, baffles, and perforated plates that direct the flow properly within the ESP while resulting in minimum system pressure loss.

The recommended modifications were installed in Fall 1999. Since the unit returned to full load operation, two significant performance improvements have been noted:

- Opacity (a measure of particulate emissions) has dropped from 18% to 7%.
- Gas conditioning via chemical injection of SO_3 is not required to achieve this opacity reduction.

Utility personnel are highly pleased with the environmental impact of reduced particulate emissions. Further, **the plant estimates a cost savings of $80,000 per year** due to elimination of the SO_3 injection.

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