Airflow Sciences Corporation

Air and Coal Balancing for Improved Combustion

Case Study

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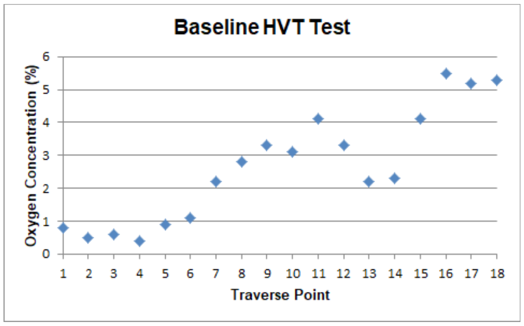

Figure 1 – As Found O_2 Profile at the Furnace Nose.

Figure 2 – Advanced Coal Flow Measurement (ACFM) Test System.

No single factor is more important for combustion efficiency in a coal-fired power plant than the distribution of coal and combustion air as they are introduced into the furnace. While it is obviously critical to have well-functioning burners and efficient heat transfer through the water wall, optimum performance cannot be achieved without the appropriate air to fuel ratio throughout the combustion zone. While these statements are widely known and understood throughout the industry, efforts to monitor and maintain these parameters are often neglected.

In 2015 Airflow Sciences Corporation (ASC) worked with one of our clients in the western United States who was experiencing extreme slagging on the water-wall tubes along with elevated LOI levels in their ash. HVT testing at the boiler nose (Figure 1) also demonstrated a major O_2 imbalance across the furnace, a telling sign of poor fuel balance.

As part of a comprehensive combustion study, the air and coal balance was determined across each mill. This testing was performed utilizing Airflow Sciences' Advanced Coal Flow Measurement System (ACFM). The ACFM (Figure 2) has the capability to follow either the ISO 9931 or the ASMC PTC 4.2 standards for pulverizer testing and represents a significant advancement over traditional testing systems. The ACFM features fully computer-controlled vacuum adjustment, ensuring that the proper isokinetic extraction rate is maintained while also providing electronic data acquisition. As a result, the influence of the operator, a prime vector for testing error in traditional systems, is virtually eliminated.

For this testing program, the baseline air and coal flow balances were demonstrated to be significantly outside of recognized industrial norms. It is generally accepted that a well-tuned boiler will have a relative air flow balance of +/- 5% across the pipes of a given mill, and a relative coal flow balance of +/- 10%. Each of the tested mills exceeded these deviations (Figures 3-5).

In order to improve the poor distribution demonstrated in the baseline testing, Airflow Sciences worked with the utility to manipulate the adjustable orifices installed in each of the coal pipes. These manipulations are typically an iterative process, so adjustable orifices offer significantly more flexibility than ring orifices (which typically require the mill to be taken off-line in order to change them). After three iterations (Figure 6-8), the relative balances were significantly improved and in most cases were brought within the recommended standards.

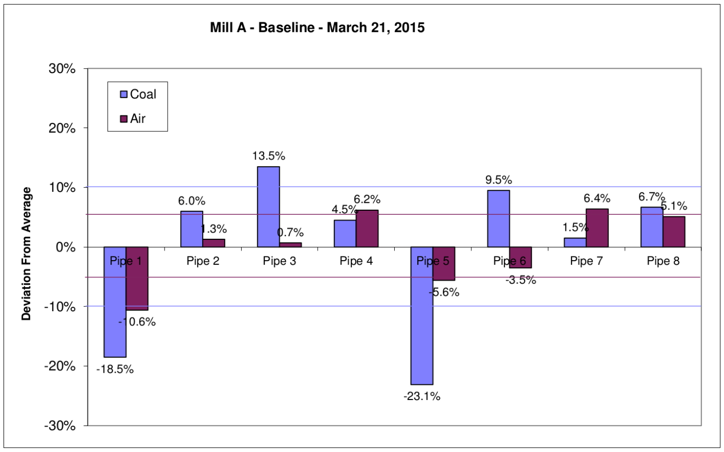

Figure 3 - Mill A Baseline Data.

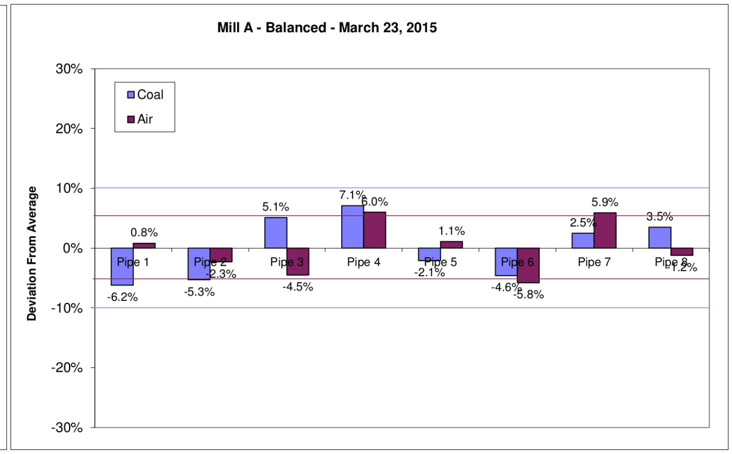

Figure 6 - Mill A Balanced Data.

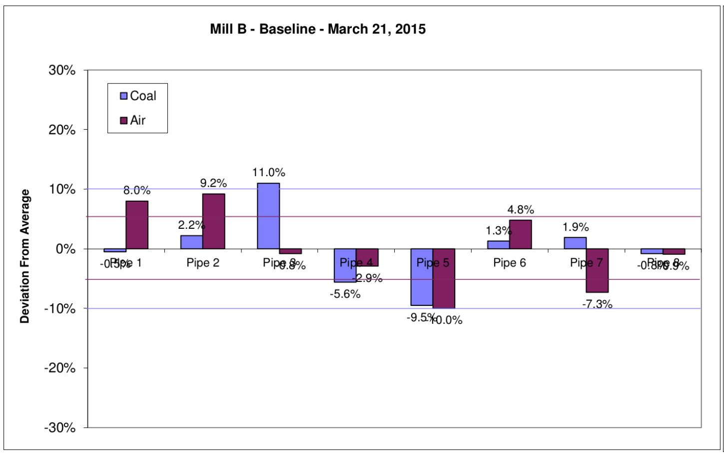

Figure 4 - Mill B Baseline Data.

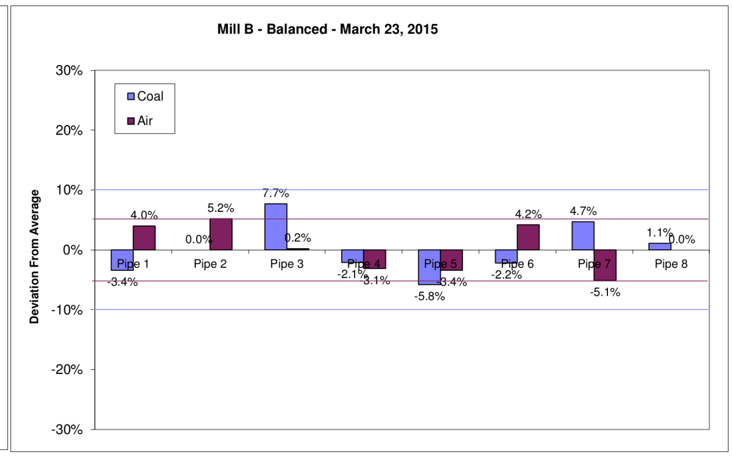

Figure 7 - Mill B Balanced Data.

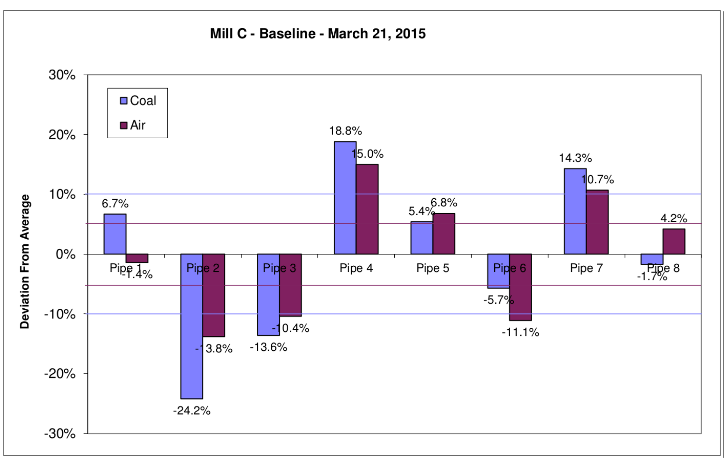

Figure 5 - Mill C Baseline Data.

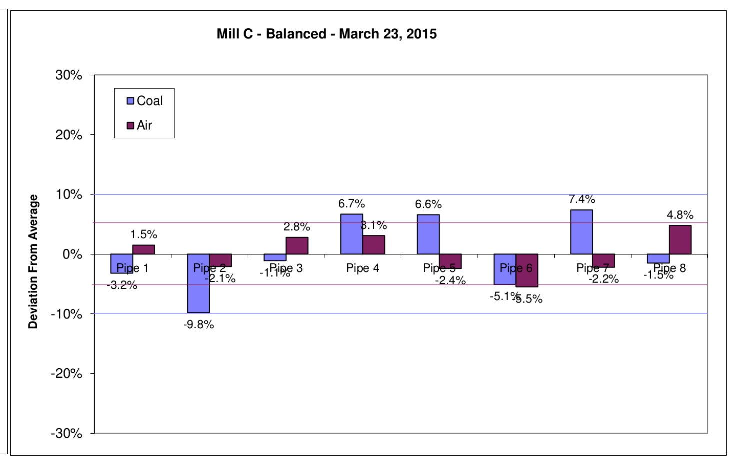

Figure 8 - Mill C Balanced Data.

Coal balanced at ±10

Air balanced at ±5

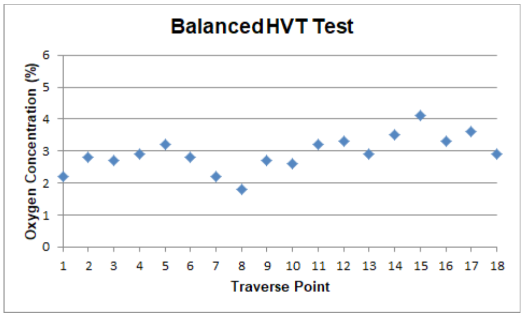

Figure 9 - As Left O_2 Profile at the Furnace Nose.

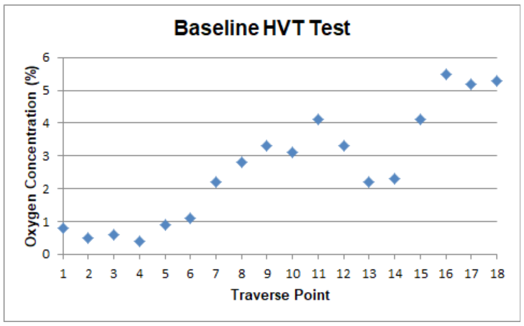

Figure 1 – As Found O_2 Profile at the Furnace Nose.

At the conclusion of the testing effort, the pipe-to-pipe balance across all three mills was significantly improved for both the air flow and the coal flow. HVT testing demonstrated that the O_2 imbalance across the furnace was dramatically improved (Figure 9) over the baseline (Figure 1 repeated). As a result, slagging was reduced and heat rate improved, allowing the plant to run with greater efficiency while reducing maintenance costs.