

# Reducing NO<sub>x</sub>

Case Study

## Location

Gallatin Station, Unit 3. TVA, Gallatin, TN

## Problem

Tennessee Valley Authority had a desire to reduce NO<sub>x</sub> levels at the Gallatin Station without installing capital intensive equipment such as SNCR or SCR. Reducing NO<sub>x</sub> is an integral part of their fleet-wide compliance plan. TVA engineers understood that more aggressive air staging could reduce NO<sub>x</sub> levels, but they were concerned with increasing the risk of tube wastage caused by low oxygen levels near the walls of the furnace that typically result with deeper staging and their 85/15 blend of PRB and western bituminous coal.

## Solution

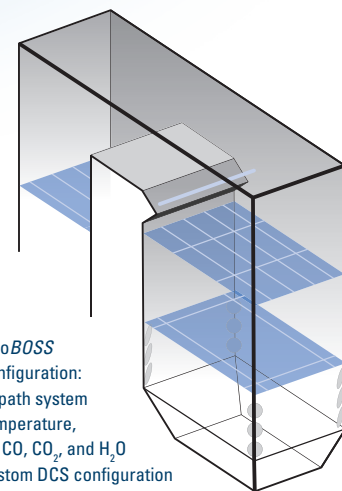
The TVA Gallatin team installed a ZoloBOSS™ system as the only instrument available to measure temperature and oxygen, in real-time, directly in the combustion zone. A total of 15 paths were installed: four along the walls above the burners in a 2 x 2 grid; six paths above the over-fired air ports in a 4 x 2 grid to measure complete combustion; one near the bull-nose to monitor furnace exit gas temperature (FEGT); and four parallel paths in the back-pass. An orthogonal grid was impossible in the back-pass due to economizer supports, but the parallel paths were placed at equal spacing across the duct with one path near the existing ZrO<sub>2</sub> sensors that Gallatin already used to monitor excess O<sub>2</sub>.

With data provided by the ZoloBOSS system, TVA was able to confirm that even at lower stoichiometries, oxygen concentrations in the primary combustion zone, especially near the walls, remained above the critical reducing levels that cause premature tube wastage. In fact, in some local areas, TVA determined that O<sub>2</sub> levels leaving the combustion zone were in excess of the desired 2% excess O<sub>2</sub> set-point. This meant that before the ZoloBOSS Gallatin operated



### TVA GALLATIN STATION DATA

Boiler Manufacturer	Alstom
Burner Configuration	Tangentially Fired
Capacity	284 MW
Coal blend	85% PRB, 15% Western Bit



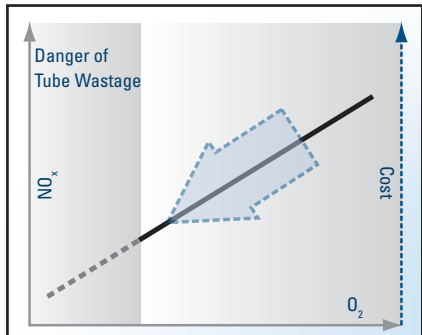
# Reducing NO<sub>x</sub>

at higher overall O<sub>2</sub> level than TVA operators were able to determine from the limited number of ZrO<sub>2</sub> sensors installed in the back-pass. With proper adjustments to air flow to balance O<sub>2</sub> levels and validation from the ZoloBOSS system, TVA was subsequently able not only to reduce emissions, but also to lower overall excess O<sub>2</sub> levels by 0.2%; a 10% improvement.

## Results

Adjustments made by TVA using guidance from the ZoloBOSS resulted in a NO<sub>x</sub> reduction of 24% to 0.16 lb/MMBtu. Based on the value of NO<sub>x</sub> credits at the time, the value of the NO<sub>x</sub> reduction at Gallatin, not including avoiding the capital cost of an SNCR or SCR, was in excess of \$330,000 in the first NO<sub>x</sub> season alone.

In addition, after successfully balancing the O<sub>2</sub> across the furnace, the reduction of 0.2% in excess O<sub>2</sub> levels resulted in an estimated 1.0% improvement in the unit's heat rate which can save \$170,000/year in fuel costs.



As excess O<sub>2</sub> increases so do both NO<sub>x</sub> and costs. Decrease too far, however, and operators risk tube wastage which can lead to costly unplanned outages.

Savings Calculation	
NO <sub>x</sub> Credit Cost	\$3,375/ton
Unit Capacity	284 MW
NO <sub>x</sub> – Before	0.21 lbs/mmBtu
NO <sub>x</sub> – After	0.16 lbs/mmBtu
Improvement	0.05 lbs/mmBtu
<b>Total NO<sub>x</sub> Savings</b>	<b>\$330,000 per year</b>

*“We were limited by how much we could reduce excess air without risking tube wastage. With the ZoloBOSS, we monitored the furnace while reducing O<sub>2</sub>, which lowered NO<sub>x</sub> without adverse effects.”*

—Robert Burbage, Project Manager, TVA

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