Coal Fired Boiler Optimization and the Impact on Emission Control Devices

Controlling NO_x and CO levels with Acceptable Performance

Storm Technologies has always focused on our "Thirteen Essentials to Optimum Combustion with Low NO_x Burners" and getting the inputs and fundamentals right!

In consideration of today's emission regulations, we have a science project taking place in coal fired boilers from the furnace to the stack. Some of the following equipment is used for the reduction of NO_x, sulfur, mercury, etc…

SNCR • SCR • ACI • DSI • Scrubbers • Fuel Additives

Now, all of this equipment has its place and can be effective in reducing emissions. However, some of this equipment can be more effective than others if combustion optimization in the furnace is achieved.

As you may be aware, CO levels are another regulated emission target that is a product of performance related items. Reduced CO levels will yield better combustion (i.e. efficiency, heat rate, and reliability). CO levels can impact fouling in the furnace, fouling in the air heater, "popcorn" ash, fouling of SCR, precipitator performance, performance of SNCR for optimum NO_x reductions, etc. By addressing the CO levels we can minimize stratification's at the furnace exit, which will allow trimming of excess oxygen freeing up some FD and ID fan capacity while reducing NO_x and CO without impacting performance.

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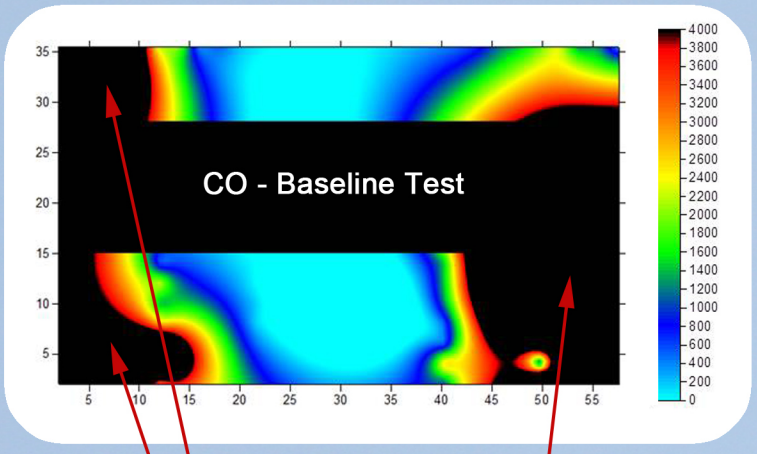

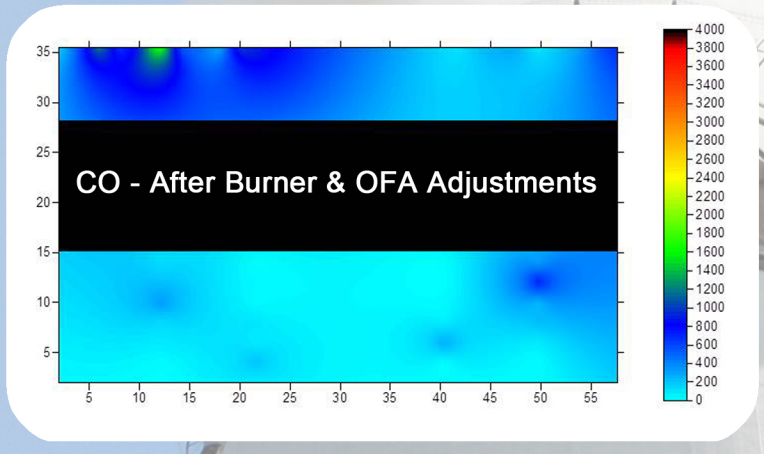

Areas where CO was over 4,000 ppm

As performance engineers, we cannot forget the fundamentals of combustion that no longer are just for heat rate and efficiency. More importantly, these inputs and fundamentals will assist with emission reduction and boiler reliability and availability in this competitive market with unit cycling due to low gas prices, renewable power and ever increasing regulations.

We have found that our philosophy of "getting the inputs right" can be applied to other combustion boilers or processes such as CFB's and Fluidized Bed Combustion systems, Kilns, etc... Basically, all fossil fuel systems need to have the air and fuel inputs measured and controlled to the best precision possible so that NO_x, CO and unburned carbon can be minimized. STORM may take a different approach than others, but this has served us well and these solutions are designed for long term operation and repeatability.

The basic need to apply correct quantities of air and fuel to each burner zone in the prescribed quantities remains important. The chemistry of combustion requires very close to the same weight of air per million Btu's of hydrocarbon fuel. For natural gas it is about 750 pounds of air per million Btu's, wood is about 800 pounds of air per million Btu's and for all coals the value is about 850 pounds of air per million Btu's.

Storm has favored and utilized venturi sections and flow nozzles for combustion airflow measurement and control for decades. No other airflow measurement devices have provided the long term, reliability and continued accuracy of flow measuring venturi and flow nozzles. In addition to airflow management, fuel/air balance to each burner is critical along with the remaining "Thirteen Essentials".

Thirteen Essentials of Optimum Combustion for Low NO_x Burners

1. Furnace exit must be oxidizing preferably, 3%.
2. Fuel lines balanced to each burner by "Clean Air" test ±2% or better.
3. Fuel lines balanced by "Dirty Air" test, using a Dirty Air Velocity Probe, to ±5% or better.
4. Fuel lines balanced in fuel flow to ±10% or better.
5. Fuel line fineness shall be 75% or more passing a 200 mesh screen. 50 mesh particles shall be less than 0.1%.
6. Primary airflow shall be accurately measured & controlled to ±3% accuracy.
7. Overfire air shall be accurately measured & controlled to ±3% accuracy.
8. Primary air/fuel ratio shall be accurately controlled when above minimum.
9. Fuel line minimum velocities shall be 3,300 fpm.
10. Mechanical tolerances of burners and dampers shall be ±1/4" or better.
11. Secondary air distribution to burners should be within ±5% to ±10%.
12. Fuel feed to the pulverizers should be smooth during load changes and measured and controlled as accurately as possible. Load cell equipped gravimetric feeders are preferred.
13. Fuel feed quality and size should be consistent. Consistent raw coal sizing of feed to pulverizers is a good start.

Let STORM work with your team today to address these Inputs and Fundamentals. It will take a TEAM effort to achieve this and achieving this will allow for improved emissions, boiler performance, and reliability/availability for improved overall operation.

One other suggestion to help demystify combustion optimization of large utility boilers is to participate in our "Large Utility Boiler Combustion and Performance Seminar" in Hilton Head, SC from June 18th-20th, 2013. Participation is by invitation only and seats are limited. Check our website for registration information.

Yours very truly,

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