PERIODIC MONITORING CAN PREVENT FORCED OUTAGES DURING PEAK DEMAND

Storm Technologies, Inc. has long been an advocate for performance-driven maintenance programs. These programs include the collection of quarterly performance test data; which is then analyzed to prioritize the scheduling of needed repairs during maintenance outages. By conducting routine performance testing on the coal pulverizers and boilers, small problems can be identified and often addressed before they potentially cause the unit to be derated or even worse, forced into an unplanned outage. These unplanned forced outages often come during peak power demand periods when the price per MW is high and it is desired for the boiler to be operated at maximum capacity with a "hands-off" operating policy.

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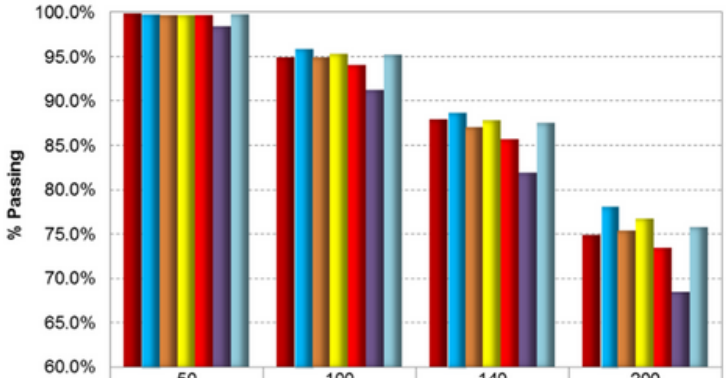
On a pulverized coal boiler, STORM considers the pulverizers the "heart" of the combustion process. If your heart is not doing its job by pumping blood to all the parts of your body, then significant problems to your health can arise if not diagnosed and treated properly. The same can be said of a pulverized coal boiler. Should the pulverizers not be "pumping" proportioned amounts of pulverized coal and air to the burners, combustion and reliability issues can occur. It is important to monitor and keep in check the pulverizers for proper fuel fineness levels, fuel balance, and air-to-fuel ratios to ensure the boiler's "heart" is operating optimally. The figure below illustrates an example where periodic testing identified a problem with a pulverizer.



	50	100	140	200
Recommended	99.9%	95.0%	88.0%	75.0%
Apr-08	100%	96%	89%	78%
Jan-12	100%	95%	87%	75%
Apr-13	100%	95%	88%	77%
Nov-13	100%	94%	86%	74%
Apr-14	98%	91%	82%	69%
May-14	100%	95%	88%	76%

Figure 1: Importance of Periodic Pulverizer Performance Testing

Pulverizer performance was found to be at the desired level for many years when suddenly the fineness level dropped steeply. Once the drop in fuel fineness was identified, the plant was able to correct the classifier mechanical issue which was causing the problem and quickly restore the pulverizer's performance to historical levels in a short amount of time. This type of decrease in fuel fineness levels, as shown in the following figure, can lead to increased furnace exit gas temperatures (FEGT), boiler tube fouling/slagging, NOx levels, loss on ignition (LOI), and much more.

For the optimum combustion of pulverized coal, it is necessary to have a completely oxidizing furnace. This is the presence of excess oxygen across the entire furnace exit, typically desired to be 3% O2. However, the excess oxygen is measured and controlled at the economizer outlet and not within the furnace where combustion is taking place. The boiler controls manage or trim excess oxygen by the use of a set of oxygen probes at the economizer outlet. Because of this, operators and other plant staff sometimes have a false sense of security regarding how much actual excess oxygen is present in the furnace. Unless localized gas sampling at the furnace exit (HVT tests) are implemented, you most likely do not know if that 3% excess oxygen setpoint your boiler is intended to be operating at is an accurate average representation across the entire furnace.

Depending on the type of coal burned at your facility, the lack of oxygen in the furnace can be the single factor that causes your boiler to slag. One cause of oxygen deficiency in the furnace may be directly related to what your economizer outlet oxygen probes are measuring. An increase in leakage from tramp air entering between the furnace and the economizer outlet oxygen probes can bring about a false reading by your oxygen probes. The probes will measure the excess oxygen at their location. Therefore there is no differentiation of where the excess oxygen came from, i.e. from the furnace or through tramp air or air leaking into the flue gas after the furnace exit. So if your oxygen probes are reading 3% but there is significant air-in-leakage introduced prior to the probes, you have less than 3% total oxygen in the furnace and some localized areas of the furnace may be starved of oxygen completely.

The oxygen-starved areas in the furnace can create localized slagging; that if not addressed can lead to the slag forming across the entire superheater section or potentially blocking an entire portion of the furnace. The blocking of the furnace gas path area can accelerate the flue gas velocities and increase the tube erosion rates exponentially. Not to mention, the increasing auxiliary horsepower requirements on the fans to move the additional flue gas and combustion air volume to and from the boiler. As well as the degraded performance of back-end equipment due to increased flue gas volume and velocities.

The amount of air-in-leakage, or tramp air, into the boiler casing often increases slowly over time. The leakage grows out of sight and out of the mind of operators until the boiler becomes severely slagged or must be derated because the unit is out of induced draft fan capacity. Air-in-leakage rarely pops up overnight; so annual testing can help to track leakage rates across the entire system. The figure below illustrates an air-in-leakage comparison over two years of testing at a facility that provides trends showing increasing and decreasing leakage rates associated with maintenance.

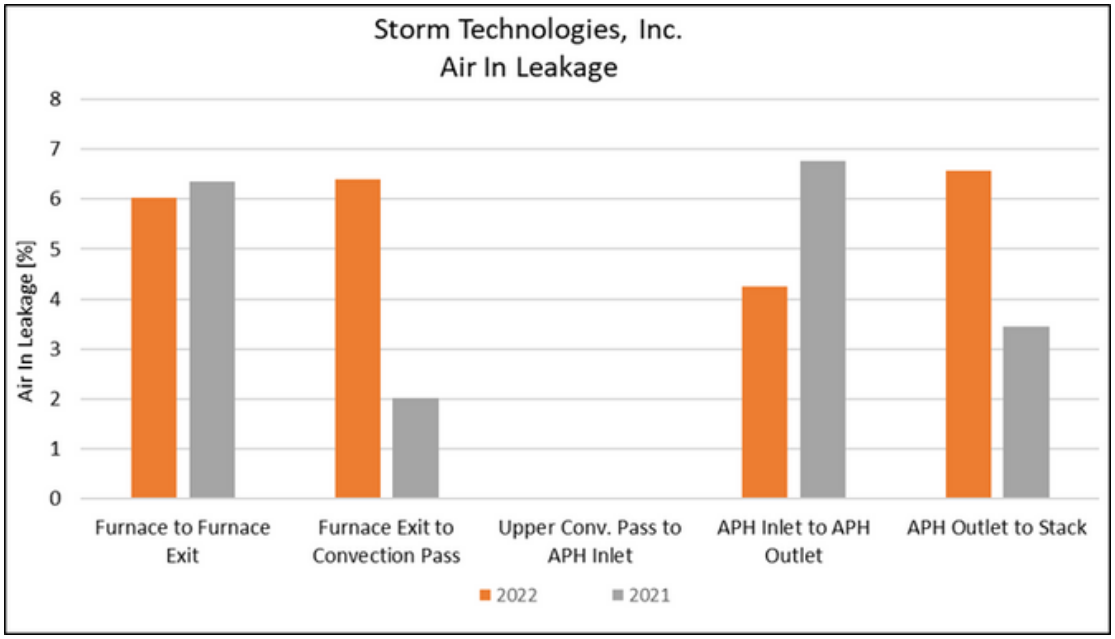


Figure 2: Annual Air In-Leakage Comparison

The compounding effect of poor pulverizer performance leading to fuel-rich zones in the furnace with just a few percent of air-in-leakage can quickly result in slagging issues such as the ones shown in the images on the left. Slagging issues as shown can force a boiler offline in the matter of a single shift. By routinely performing comprehensive performance evaluations of your facility, you can identify and eliminate the variables and/or factors that can cause a derate or forced outage.

Figure 3: Furnace Slagging Resulting in a Forced Outage

In addition to performance and reliability factors, there are also emission regulations plants must abide by to continue operating. For one, NOx emissions seem to get tighter each year and one of the easiest methods to reduce in-furnace NOx production is to limit the amount of excess oxygen available. However, if periodic testing and tuning efforts are not completed, your boiler can end up the same as a boiler with excessive leakage upstream of the excess oxygen probes. Reducing excess air levels to meet NOx requirements or to reduce the load on your SCR/SNCR without periodic testing/tuning can lead to increased waterwall wastage, elevated spray flows, and increased slagging to name a few.

The new year has just started, so do not let this opportunity pass to identify controllable performance factors that could potentially derate or take your boiler offline this year. Contact Storm Technologies, Inc. at 704-983-2040 or through our website (www.stormeng.com) if you would like to speak with a combustion expert about evaluating the combustion performance at your facility.

Respectfully,

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Disclaimer: These suggestions are offered in the spirit of sharing our favorable experiences over many years. Storm Technologies, Inc. does not accept responsibility for the actions of others who may attempt to apply our suggestions without Storm Technologies' involvement.