Three Tips on Applying Performance Driven Maintenance

Coal pulverizers are the heart of a pulverized coal power plant.

The importance of periodic testing and tuning is more important now than ever. Here are some of the reasons of why I make this statement:

- Operations and Maintenance budgets are slimmer than ever in my recollection
- Varied fuels are being fired as part of competitive generation strategies. As higher sulfur, higher iron content fuel ashes are fired, slagging and fouling becomes more of an issue. Mill performance then becomes even more important.
- Performance testing can provide important feedback for the most efficient use of maintenance dollars
- Combining testing with O&M provides insight on achieving the most efficient operation, best heat rate, highest capacity, best reliability and lowest emissions
- Ever more stringent emissions levels, such as CO require more precise fuel fineness, distribution and air/fuel ratios. For a pulverized coal fueled boiler, the pulverizer is the heart of the fuel burning system.
- Air in leakage on balanced draft (most) boilers increases silently and creeps up with time. This can be found with periodic furnace oxygen checks.

Here are three periodic tests that we consider an important component of a "**Performance Driven Maintenance Program**". These can be used to apply cost-effective maintenance. Also, from our experience, these are frequently found opportunities of "low hanging fruit".

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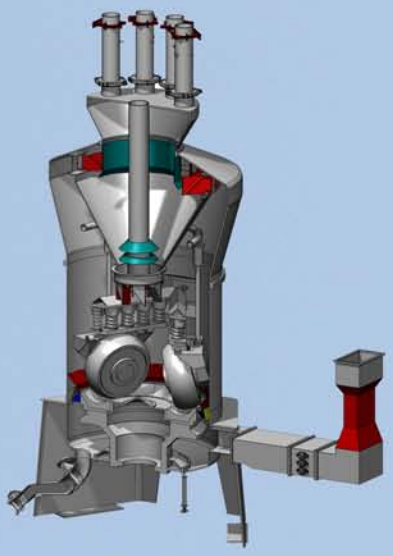
First, check the pulverizer performance.

The mills are the heart of a combustion system, so if top performance is expected, mill performance needs to be verified.



Just because a pulverizer is overhauled, doesn't mean that the pulverized coal fineness exiting the mill is up to standards (at least 75% passing a 200 mesh sieve). We have seen it over and over again. Coal pulverizers are overhauled at the prescribed maintenance interval, which may be 7,000 hours, 500,000 tons of throughput or a certain number of months. The management expectations are overhaul the mills and presto, fineness will be good. The overhaul may include a fairly extensive maintenance procedure such as: replace the grinding elements, replace worn areas of the classifier cones and blades, check spring tension, "Blueprint" the clearances and dimensions to what is known to be optimum, and then return the mill to service. Expect good fineness. While on first appearance this looks standard and satisfactory, in our experience, it just does not always work this way. We have seen many situations where all of the right operations, calibrations and maintenance tasks were done, yet the coal fineness coming from a freshly rebuilt pulverizer was poor. Keep in mind, that the pulverizers are the heart of a pulverized coal fueled boiler combustion system. Nine of the Thirteen Essentials are related to the mills.

For example, following a MPS-89 overhaul fineness was found to be poor. The reason? High primary airflow. This is the most common cause of poor fuel fineness. The primary air/fuel ratio was high at 2.3 pounds of air per pound of fuel. When the primary airflow was lowered to the optimum air/fuel ratio, the fineness improved from the mid 60% levels passing a 200 mesh sieve, to the mid 70's. This is very common. Undesirably high primary airflow not only contributes to poor fuel fineness, but also to longer flames, increased fuel imbalance, higher CO levels, higher peak flame temperatures at the superheater and pockets of the products of combustion being in a reducing atmosphere at the upper furnace. This contributes to slagging when a fuel of high iron content ash is fired.

On another plant where the mills were equipped with dynamic classifiers, the mills were periodically tested at a classifier speed of 170 rpm by the plant staff. Yet the day to day operation was with classifier speeds of 160 or less rpm with poor fineness. Why? Because the performance of the mills (and furnace combustion efficacy) at lower classifier rotational speeds were not understood by operations. At this plant when the classifier speed was slightly increased just 10 rpm to ~170 rpm the flyash carbon content dropped, 15% in LOI (Loss on Ignition).

Higher than preferred primary airflow is a standout cause of poor mill performance. We see it year after year. Just because the primary elements for the primary airflow measuring device were purchased for extreme accuracy, doesn't mean that they are delivering accurate primary airflow's! We recommend periodic "Hot-K" calibrations of the primary elements and also fuel line dirty air and isokinetic coal sampling to verify performance.

Below are examples of actual data that show the relationship of primary airflow's and fuel fineness and distribution.

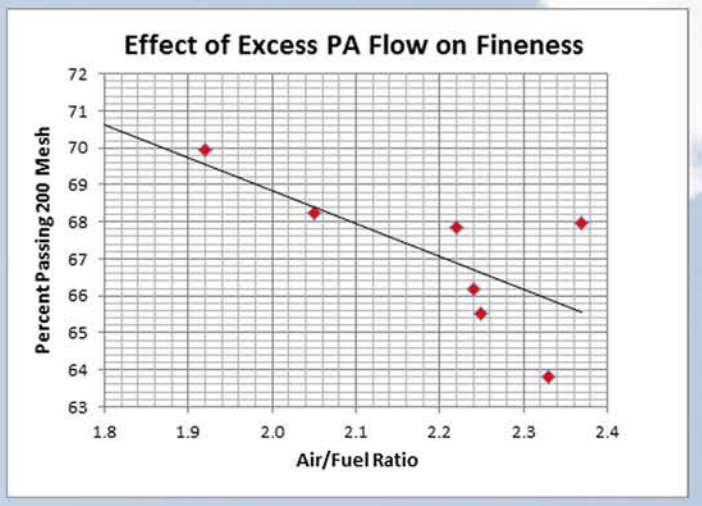


Figure 1

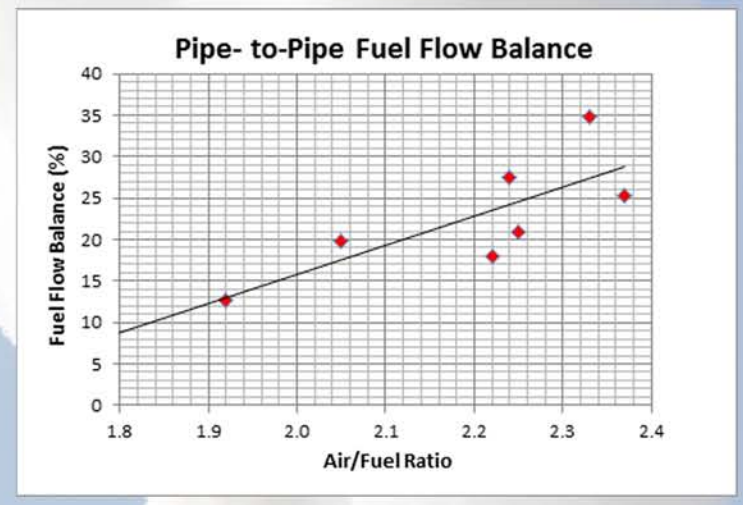
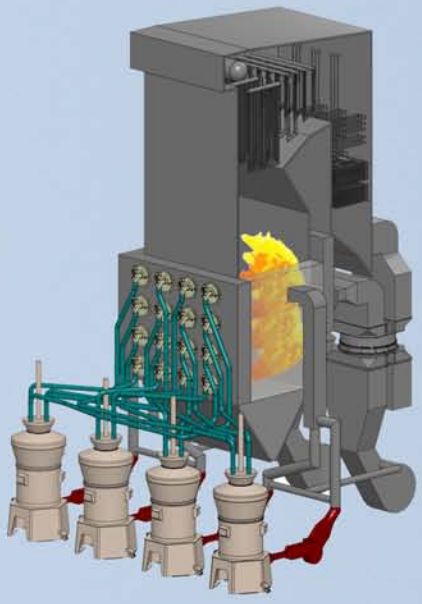


Figure 2

This is a typical trend of how fuel fineness deteriorates as primary airflow is increased above optimum.



Second, check furnace oxygen levels, another "stealthy loss"

Another one of the most common opportunities for improvement is insufficient combustion air in the furnace. Most large utility boilers use oxygen analyzers installed at the boiler economizer exit gas ducts. Because of the age of the boilers and the reduced frequency of overhauls, many boilers have significant air in-leakage between the furnace exit and the oxygen analyzers. From a combustion standpoint, any air that seeps into the furnace post combustion does nothing for completing combustion, yet it still registers on the oxygen analyzers as "Excess Oxygen". Often, we find the oxygen rise from the furnace to the economizer outlet to be more than 2% oxygen rise. This represents the equivalent of about 10% of the total air for combustion. When a boiler is operated with the furnace exit as low as 1% oxygen, the CO levels are usually extreme, into the 4,000 ppm+ range. Carbon monoxide will still burn out as the flue gases pass through the convection pass and cool down to about 1,350 degrees F. So, the stack CO levels may be reasonable, yet close to the limit when portions of the furnace is in an oxygen starved condition.

Third, perform periodic flyash sampling

Periodic sampling of flyash at the boiler exit can be very informative. The key is to obtain representative flyash samples. Easier said than done! Don't use electrostatic precipitator or baghouse hopper samples! Our preferred tool for sampling flyash is the flue inserted flyash sampler. Not only is it useful to determine the true flyash carbon content, but representative flyash samples are useful to monitor pulverizer performance on PC boilers. How? By taking a representative ash sample and applying the three part flyash LOI test. This is to first measure the flyash LOI of the ash as collected for each duct. Secondly, sieve a portion of the ash through a 200 mesh sieve. Then determine the LOI of both the fine ash (passing the 200 mesh sieve) and the coarse ash (remaining on 200 mesh sieve). If the composite ash (fines and coarse) is say 10% LOI, and the fine ash is 2% LOI, then the problem causing the poor LOI is pulverizer related. This is a very easy test to do; the hardest part is getting representative ash samples.

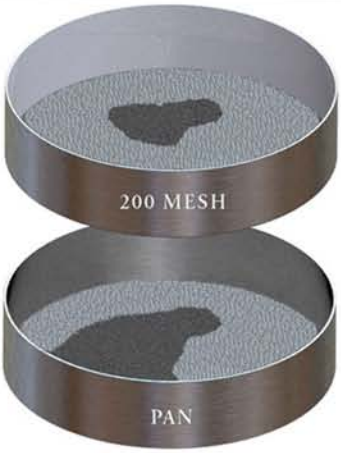
If the fine particles (less than 200 mesh size) are high in carbon content, then the problem is not pulverizer related, but more likely insufficient furnace oxygen or poor fuel balancing. To make it easier for the technicians who collect the samples of ash, permanent mounting of the flyash sampler with well pulley hoists for lowering the probes, permanent compressed air piping etc can make this a relatively convenient method of performing "Performance Driven Maintenance"

These are three relatively quick tests that our Field Service Engineers regularly perform. Some more information on testing, Performance Driven Maintenance and Applying the Fundamentals for Performance Optimization are included in some recent presentations by Shawn Cochran, Adam McClellan, Danny Storm and myself. These can be found on our web site at www.stormeng.com.

The recent presentations at the EPRI Heat-Rate Conference on Performance Driven Maintenance and Coal Fired Boiler Optimization and the Impact on Emission Control Devices may be of particular interest. These are also found on our website.

Storm Technologies has another Boiler Seminar coming up June 18th - 20th, 2013. Registration information on this is included on our web site and in this newsletter. Hope to see

If you have any questions or comments, kindly let us know!



Place 50 grams of ash on the 200 mesh for sieve analysis

Determine L.O.I. of residue on 200 mesh sieve and in pan

L.O.I. of fine ash must be less than 2% (low volatile eastern fuels); or less than 0.5% (high volatile western fuels) such as PRB

Figure 3: Three Part Flyash Sieve / LOI Analysis

Yours very truly,

Richard F. Storm

Dick Storm
Senior Consultant

Large Electric Utility Boiler Combustion And Performance Optimization Seminar

VENUE: Sonesta Resort - Hilton Head Island, 130 Shipyard Dr Hilton Head Island, SC 29928

Registration:

To secure a seat for the short course, please fill out the bottom information and either email, fax, or mail or entry. For any further information, please feel free to call the office at (704) 983-2040

Email Registration to : storm@stormeng.com
Fax Registration to : (704) 982-9657
Mail Registration to : PO Box 429, Albemarle, NC 28001
*Limited to 25 participants and first come availability to Storm customer base

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