CORRECTING COAL ASH CHEMISTRY WITH COAL TREAT LEADS TO IMPROVED BOILER OPERATIONS

Speaker: Mark Pastore - VP, Technology Environmental Energy Services

1. **Is there a relationship between LOI and the amount of chemical additive?**

   No, we have not seen any relationship to LOI related to the additive dosage in the work we have done.

2. **Are there hazardous chemical handling logistics that needed to be implemented with any of the EES's proprietary additives?**

   All of the main chemicals that we use; the magnesium, the calcium, the aluminum, the clay-based chemicals are all benign and non-hazardous. If we have to use the copper chemical, it does have some safety concerns with it. We do not use that chemical frequently and we provide the SDS sheet, of course in advance to get that chemical approved.

3. **The additives provided by EES, are they in liquid or powder form?**

   They are liquid slurry that are able to be pumped and applied to the coal. We do not typically use solid based reagents.

4. **A question on ash fusion test. What is the detection limits in the ash fusion tests. Are your results within or beyond that limit?**

   Most of the results that we see are within the limits of the ASTM method. The ash fusion test can only measure up to 2700-degree Fahrenheit. Anything above that would be recorded as 2700 plus. Most of what we look at starts around 1900 to 2100 degrees and then we're modifying it by 50 to 150 sometimes 200 degrees so we fall within the normal operating range of the test method.

5. **Can you selectively treat high load silos only?**

   Yes, this is something that is coming up frequently with different customers. Depending on the configuration we can dose on tripper car location. We can take a signal from the tripper car and when it is going to be bunkering over the high load silos that feed the mills that operate at high loads, that would turn the system on only when they are bunkering those particular silos, so that can be done. We only recommend this strategy if those mills are providing good distribution throughout the furnace.

6. **Does EES offer Design/Build solutions for additive systems? Specifically, would EES be willing to take on silo, belt or mill equipment design and procurement when retrofitting the additive treatment system?**

   We typically install the chemical application line, the piping that goes to the belt. The chemical would be applied to the coal with those lines. We would provide the pumping systems, but we would have the customer do any modifications to their plant, including installing bulk storage tanks, mixers, etc.. If there are any modifications to the equipment or major equipment site-work, we don't really act as an EPC. We will just provide the trailer mount system and over sight.

7. **Do you have any examples of coal units utilizing fly ash re-sale? Implementing the EES coal additives, and still being able to sell the Fly Ash? Does the additive make the fly ash unsaleable?**

   The amount of change that occurs with our dosage level in the fly ash is small. The minerals that we are adding do not have a negative effect on fly ash being sold for cement or concrete applications. I think some of our customers are selling their fly ash but I don't know for sure. I know we don't cause any major changes to the composition of the fly ash at the dosage levels typically used in the field.

8. **What is a typical onsite additive storage volume timeframe that you've seen in the past? 7-day silos, 12-month silos, etc. What kind of volumes have you seen in the past?**

   Our chemicals are typically stored in 9 to 12,000-gallon tanks which would provide enough for 7-10 days at full load at a high dosage rate for a typical boiler. We design our systems for 7-10 days of storage.

9. **You mentioned consistent application of the coal additives, or 'temporary treatment; what effect does the additive have on a boiler that has already been accumulating ash layers for months. Are the existing and hard to reach slag deposits staying put or will the additive 'penetrate' existing deposits?**

   The additive will work on existing deposits. Slag on boiler tubes is actually a very viscous fluid just like glass. Contaminants in the ash such as alkalis, transition metals, etc. and our chemicals are soluble in the glassy matrix even though it looks like a solid ash. We prefer to treat a dirty boiler because our customer can have the option to use the chemical on demand and not have to clean the boiler prior to using CoalTreat. Because our chemical is applied pre-combustion, it will follow the gas path and the flow of ash particles allowing it to reach all of the pre-existing deposits throughout the operating range of the boiler.

10. **What are the typical impacts to NOx and mercury emissions?**

    We have not seen an impact on NOx or Hg emissions, positive or negative with coal treat at the dosage level we are applying.

11. **Have you seen any adverse effects on with Flue Gas Desulfurization, in particular this client has a Jet Bubbling Reactor, that's Chiyoda technology I believe? Have you seen adverse effects on SO2?**

    No. If we were to apply really high dosage levels of magnesium and calcium (over 4 lbs/ton), those oxidized minerals that made it through to the backend flue gas and into the scrubber would actually act as alkalinity or reserve alkalinity for the FGD. In one case, while using a high dosage level for SO3 capture, we saw a decrease in the amount of limestone required for make-up in the absorber slurry.

12. **What is the level of precision of the ash fusion test in degrees?**

    The precision is plus or minus 50 degrees when the same operator runs the test. If it is two different laboratories, the error would be plus or minus 75 degree. We have only had the same person in the laboratory run the test so we can say confidently, if we see more than a 50-degree difference, we call that a real difference. If it is less than 50 degrees it is not a real change, it's within experimental error.

13. **Do you require boiler tuning with implementation?**

    It is not required but we highly recommend boiler tuning to fully take advantage of CoalTreat benefits. We discussed earlier about distribution of oxygen. If there is no oxygen present, no matter what we add, all we will be doing is fluxing the glass at that point. Oxygen is needed to make the crystal structures that will help fracture the deposits and make them more brittle. So proper oxygen distribution is critical and also the mills should be performing well. We don't necessarily need to throw a band aid on a problem that's happening because of mill performance or poor distribution of oxygen or CO throughout the furnace. We would like to see it tuned up before we get there. Then we know we are dealing with a pure chemical problem.

14. **Has any customer successfully applied the coal treat products at the mine load out to help minimize plant O&M costs?**

    It is something that we are actively pursuing but do not have anyone doing at this time. We had conducted some tests with Consol Corporation a couple of years ago to see if our chemical would wash off from the coal pile and the magnesium chemistry has a tendency to partially wash off with the equivalent of 4 inches of rain fall. The calcium compound we use stayed on the coal with-out an issue even during similar rain simulation. There is potential that it could be treated prior to the plant, but we may have to adjust the magnesium level on site with a scaled down on-demand system. If 40 percent of the magnesium is washed away in coal train, we would replace it on demand. This is something that we are looking at, it is definitely possible, and we would like to pursue it.

15. **How long do I have to run a trial for to see the benefits of CoalTreat solution?**

    The initial effects are seen right away. When we run the HTP test, it is real time flue gas capture of the deposit, so we see results right away. We see the shedding starting as soon as four hours to a couple of days so we like to run a test for at least one to two weeks and typically a customer might want to go for an additional week or two if they want to see some boiler DCS trending. But visual and HTP results can be seen quickly. So, 7- to 12-day trial is a good starting point.