DeVore, Christy

From: White, Kevin [KWHITE@southernco.com]
Sent: Tuesday, March 09, 2010 11:44 AM
To: Koerner, Jeff; DeVore, Christy
Subject: FW: Additional Information Request by FDEP for Fuel tech Boiler Additive

Jeff & Christy,

Per your request, we are supplying Mr. Doug Gagnon of Fuel Tech's responses to your questions. Unfortunately, there are no papers currently available on the use of the TIFI XP boiler additive. As stated in Mr. Gagon's email, he has been an integral part in developing this technology and therefore should be deemed an expert.

Although the available documentation on the use of TIFI MG and TIFI XP (below email) claim a reduction in SO3 or sulfuric acid mist (SAM) emissions, control efficiency varies based on pant specific characteristics (i.e. coal quality, SCR specifics, climate, etc.). Gulf Power is not currently planning to utilize this technology for SAM control. As you both are aware, existing construction permit applications are in-house that address SAM at Plant Crist. Due to this application not addressing or claim SAM reduction and the construction schedule of the additional in-house construction permit applications, this proposed boiler additive application was submitted separately. It was our intention that this project request no interfere with the review and processing of the additional in-house projects.

We anticipate the below information will answer your questions concerning the proposed TIFI boiler additive project. However, if you have any additional questions for Fuel Tech or Gulf Power, please let me know.

Thanks!

Kevin M. White, P.E.
Gulf Power Company
Environmental Affairs
850-444-6537 (office)
850-336-6222 (cell)

-----Original Message-----
From: Doug Gagnon [mailto:dgagnon@ftek.com]
Sent: Sunday, March 07, 2010 3:28 PM
To: Young, Melvin A., III
Cc: White, Kevin
Subject: RE: Additional Information Request by FDEP for Fuel tech Boiler Additive

Mel,

For the most part these are chemistry questions and since I helped invent the technology, these are in my domain. I have copied and pasted the questions below so that each one can be addressed.

The final two or three questions are a combination of chemistry and business questions. I need to state that the plant has not stated to me its intent as far as its ultimate business goal. I understand that the plant wants to be able to burn different quality coals, based on economics. That's not a problem. However, the amount of reagent (combined TIFI MG and TIFI XP) that enables the plant to burn these coals may not be enough to eliminate all of the SO3 down to a point where there will be no "blue plume". Elimination of "blue plume" is dependant

on several independent variables and is a different goal (though entirely possible) than controlling slag for different coal.

Why TIFI XP is needed for your plant?
TIFI XP is used in conjunction with TIFI MG to mitigate slags from some coals. The TIFI XP material is used specifically to mitigate hard, tenacious slag formed by coals containing higher iron and sulfur concentrations (examples include the Northern Appalachian and Illinois Basin coals). Coals not containing high iron and sulfur concentrations usually require only the TIFI MG material (examples include Powder River Basin and Central Appalachian coals).

What will it do differently than TIFI MG?
TIFI MG alone would not be as effective as the combination of TIFI MG and TIFI XP in handling slags from higher iron and sulfur concentration coals.

What is the driving chemical mechanism?
The driving chemical mechanism is that both TIFI MG and TIFI XP interfere with the cross-linking of the ash's chemical constituents that elements such as aluminum, calcium, silica, sulfur and iron can sometimes cause. The cross-linking makes the ash act as if the ash material is fused and polymerized. This cross-linked material becomes very dense and heavy and adheres tenaciously to the boiler's tubes, sidewalls and other furnace parts. These heavy slag deposits block draft, impede heat transfer, can cause a de-rate. In addition that will accelerate certain types of high temperature corrosion mechanisms that can occur with some coals. As such, keeping the ash from becoming cross-linked, agglomerating and forming heavy, dense slag is vital to minimizing operating costs and capital repair costs.

With respect to SO3 capture the chemical mechanism for TIFI XP is:

$Al2O3 + H2SO4 \rightarrow Al2(SO4)3 \cdot H2O$

What are the benefits from using this product?

The benefits of using the TIFI XP material are:
Clinkers & Slag Falls: TIFI MG and TIFI XP stop cross-linking of the ash from lower iron and sulfur concentration coals so the ash can be removed by soot blowing (and will mostly end up in bottom ash and fly ash with the balance [an amount no higher than usual] removed by the ESP) and will be far less adherent. As such, the treated ash will not tend to form clinkers and heavy adhered slag deposits. Slag falls from heavy accumulations of dense, hard slags (clinkers) can damage the bottom of the furnace when chunks of this dense, heavy slag falls and strikes the furnace bottom. Imagine a 10,000 pound, rock-hard mass falling 4 to 5 stories to the bottom of the furnace. The damage from slag falls can cost several hundred, if not millions of dollars, to repair.

Boiler efficiency: Slag deposits reduce heat transfer and thus reduce boiler efficiency. Keeping ash from creating the insulating slag deposits is a way to maximize heat transfer, and thus, furnace efficiency. This minimizes operational costs for the plant. Typically treated furnaces are 0.75% to 2.5% higher in boiler efficiency than untreated furnaces burning the same coal simply due to keeping heat transfer and draft maximized.

Heat Rate: Slag deposits reduce heat transfer and thus, increase operating costs. Sometimes the cost is from excess re-heat spray and sometimes from just higher furnace exit gas

temperatures or air heater fouling. By keeping ash from creating the insulating slag deposits and impacting design boiler draft, heat rate is kept as low as possible. This minimizes operational costs for the plant.

Corrosion: By keeping adherent slag off furnace tubes and walls, corrosion that occurs from elements such as chlorine and sulfur is greatly reduced. Corrosion of deposited, un-passivated tubes (tubes naturally passivate themselves if deposits are kept off of the tubes)in some cases can result in the need for down-time for water-wall and stainless tube bank replacement. The use of the TIFI MG and the TIFI XP materials has shown that these corrosion mechanisms have been kept in check when used with the high chloride coals .

Further benefits of using the TIFI MG and TIFI XP combination are:
Ash chunks that the clinker grinder sees are much easier to grind and clinker grinder maintenance goes down.
Any problems with popcorn ash that can block the entrance to the SCR's catalyst is eliminated. Gas (and entrained ash) flow through the catalyst remains as designed which, in turn, maximizes Nox reduction and minimizes ammonia demand.
Catalyst poisoning is reduced dramatically.
Reduction/elimination of ABS fouling in air heaters. The need for air heater washing is usually eliminated.
Extension of time between furnace cleaning cycles Reduction of time for furnace cleaning Reduction of time for ESP cleaning Reduction to elimination of the need to load shed to de-slag Reduction (or elimination depending on the plant's goal) of the need for SO3 mitigation with SBS, Trona and/or other materials is reduced and can be eliminated.
Reduction in duct corrosion
Reduction in acid dew point

What are the expected emissions increases/reductions?
There are no expected air emissions increases. All of the inorganic additives react and end up in the bottom ash, fly ash and/or the ESP ash. The amount of material injected is less than 0.5% of the ash.

Regardless of whether the plant's goal is slag control, SO3 control, or both, if one takes the time to consider the stoichiometry required to achieve the results we achieve, it becomes clear that the equations above do not entirely explain what we do. Our reagent utilization is severely sub-stoichiometric for slag control and also sub-stoichiometric for SO3 reduction. In other words we accomplish far more than the amount of reagent we would need if only the redox reactions above defined the mechanism. This is because of the way in which the Computational Fluid Dynamic modeling, selection on injection locations and in-furnace injection is accomplished. However, it should be noted that 100% of the reagent we inject is reacted and ends up in the ash as either MgS04 or if in the case the reagent is drastically overdosed, MgO. Typically our spent reagent comprises less than 0.5% of the ash's mass. In our applications, there is no difference in the total ash captured by the ESP whether we treat a furnace, or not. As such, virtually 100% of our reagent is captured. It should also be noted that neither TIFI MG or TIFI XP forms any compounds that are not already present in coal ash.

The expected SO3 emission reduction depends on the dosage of the TIFI MG and/or TIFI XP reagents. It needs to be noted that SCRs vary from plant to plant. Some have more layers of catalyst than others, entering gas temperatures vary, catalyst age varies and flow characteristics through the catalysts varies in addition to the brand of catalyst. All of these have an impact on the amount of SO3 created by the catalyst. But, we do know that all catalysts increase the SO3 in the flue gas. So if we measure between the furnace exit and the air heater exit, the reduction will be lower than between the SCR exit and air heater exit.

If the plant wishes to dose for SO3 removal in order to depress the acid dew point or eliminate acid mist and/or blue plume, a higher dosage of reagent may be required.

I hope the above has answered your questions and I hope the frame of reference from a business standpoint accurately reflects the plants intention for the use of this patented technology. Please call me at 407-862-1842 if you have any further questions.

Regards,

Douglas C. Gagnon
Fuel Tech, Inc
Technologies to enable clean efficient energyTM

Email address: dgagnon@ftek.com
Office phone & cell phone: 407-862-1842
Company Website: www://ftek.com (NASDAQ: FTEK)

-----Original Message-----
From: Young, Melvin A., III [mailto:MAYOUNG@southernco.com]
Sent: Friday, March 05, 2010 10:47 AM
To: Doug Gagnon
Cc: White, Kevin
Subject: FW: Additional Information Request by FDEP for Fuel tech Boiler Additive

Hey Doug,
You can read below that the DEP is asking some questions on the aluminum hydroxide process. We would like to get them a response to them as early as we can next week. Give me a call and let me know what is doable.
Hope everything is going your way.
Talk to you soon,
Mel

From: White, Kevin
Sent: Friday, March 05, 2010 9:07 AM
To: Young, Melvin A., III
Subject: Additional Information Request by FDEP for Fuel tech Boiler Additive

Mel,

The FDEP haws come up with a couple of questions from our air permit application for TIFI at Plant Crist. They have visited the Fuel Tech website and obtained plenty of information on the injection of Magnesium Hydroxide (TIFI MG), but were unable to find any specific information about the us of Aluminum Hydroxide (TIFI XP) injection. Below is a copy of their correspondence containing the information they are requesting.

Please discuss this request with your Fuel Tech representative to determine what documentation they can provide on TIFI XP.

Thanks!

Kevin M. White, P.E.
Environmental Affairs
Gulf Power Company
Phone: 850-444-6537

Cell: 850-336-6222

Kevin,
Based on the excellent Fuel Tech report, we have a good idea of what TIFI MG (magnesium hydroxide) is intended to do.
We have NO information on what TIFI XP (aluminum hydroxide) will do or its purpose.
Please contact Fuel Tech and get us some information on: Why TIFI XP is needed for your plant? What will it do differently than TIFI MG? What is the driving chemical mechanism? What are the benefits from using this product? What are the expected emissions increases/reductions?
For example, for TIFI MF, the report indicates:
· Why TIFI MG is needed?
Control opacity by reducing SAM; reducing SAM reduces slag and fouling; reducing slag and fouling results in better combustion efficiency, which also reduced SAM.
· What is the driving chemical mechanism?
$MgO + SO3 \rightarrow MgSO4$
$Mg(OH)2 + H2SO4 \rightarrow MgSO4 \cdot 2(H2O)$
$MgO + H2SO4 \rightarrow MgSO4 \cdot H2O$
· What are the benefits from using this product?
Reduced SAM; reduced opacity; improved air heat efficiency; improved boiler efficiency; improved generation rate; improved heat rate; allowed for fuel flexibility; reduced slagging; and reduced outage time for cleaning.
· What are the expected emissions increases/reductions?
35% reduction in SAM; eliminated visible plume.
We prefer something like this from Fuel Tech for TIFI XP.
Thanks!