KEYS TO COMBUSTION & EMISSIONS OPTIMIZATION: STEP-WISE NOx REDUCTION, FUEL SWITCHING AND COMBUSTION OPTIMIZATION

Speaker: Robert Santangeli, P.E. | Director of Engineering

1. **Have you provided gas conversions for stoker type boilers? If so, do you do the grate demolition?**

   Yes, we have provided two different conversions for stoker applications; we have done both wall-fired modifications where we will add a gas burner to the side wall and of course it doesn't require a removal of the grates. We have also, and recommend, the approach to remove the grates and add up fired burners in the stoker where is that possible. We have better performance, slightly better performance with the up fired configuration. But we have provided both.

2. **You mention that you have used 40% urea solution in your SNCR systems. When you're at the injector what is your typical concentration by the time the reagent reaches the injector?**

   We use 40% solutions or in some cases 32.5% and depending on where the system is located. Obviously the higher the percentage, the higher the freezing point and more heating that's required. But in general, all the systems are diluted at the metering skid with clean water and we have a very specific requirement for that dilution water and the reagent, urea, is injected at somewhere about 7-10%.

3. **Do you provide urea to ammonia conversion equipment for a typical SCR – SNCR application, such as Hydrolyzer and Pyrolysis - do you provide that?**

   Yes, we have for some turbine SCR applications, we have provided urea and can provide urea to ammonia systems.

4. **Coal-fired boiler with high LOI. What can we do to improve the burn out?**

   High LOI can be caused by several things. Could be fuel air balancing, it could be a function of the burner itself. Depending on the fuel, if there has been any change in fuel, sometimes low volatile coals require more swirl to get a better burn out. Also, you need to look at the coal type and whether there is any is any issues with coal roping. So ,you have many applications where what coal can tend to do, if it's not well mixed, you get what I refer to you as a coal rope that carries through into the furnace and what that is, is just a concentrated stream of particles that doesn't mix well and does not burn out. These are all things that can affect your LOI.

5. **In tangential fired boilers, does STEP provide tilting or fixed gas burner arrangements?**

   We have different designs for both. So we have provided gas burners for both fixed T's and tilting units. Where we're working with the tilting units, in the past, we preferred to keep tilting capability, other manufacturers, I've seen several retrofits where they remove or take those buckets out. But we can generally achieve this same performance with the tilting configuration, and I feel the additional small gain in temperature control is generally worthwhile.

6. **Are there any limitations with over-fire-air and flue gas circulation systems? Any limitations to be aware of.**

   There are design considerations and sometimes there are in fact some high load or max load MCR issues and for both it is slightly dependent on fan capacity. So OFA systems can require slightly more excess O2, from .5 – 1% and they can also result in a slight increase in super heat temperatures. So if you are severely fan limited or you have super heat temperature issues it could exacerbate the issue little bit. That can usually be addressed sometimes with just tuning it back so it won't use as much at high load and FGR has similar constraints. IFGR which has to pass through the FD fan can cause limitations at high load and sometimes the IFGR is removed at high load. FGR, of course, if you are forcing it with a gas recirc fan, there is no additional limitations. You should be able to get that additional amount of gas into the furnace, of course you have ID limitations. So there is a lot of specifics there to look at, but there can be some issues at the max load if you are currently near or at a limit.

7. **I think you mentioned in the presentation that the primary air velocity should exceed 3800 feet per minute at the burner exit. Is there recommended range above that you like to see operation above that 3800?**

   We like to keep the velocity for NOx control as low as possible, but our limitation is the 3800 feet per minute. So to allow some cushion we should force 4000 feet per minute. But again, coming out of the burner we want that, generally for good combustion, we want that coal as slow as we can get it.