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SJVAPCD

Subject: URS response to the SJVAPCD BPS

Below are URS Corporation comments on the proposed BPS. Please feel free to call at (714) 433-7773 or respond by E-mail if you have any questions or comments. URS Corporation is a large engineering company that has been designed and installed many ultra low NOx burners, SCR systems and advanced heat recovery systems throughout the US, including many in the Central Valley.

1. In a rule that has such wide reaching cost implications can you comment on the lack of long term, third party, data to support the efficiency numbers presented. Rather than using sales brochures from companies (RF McDonald and Nationwide) that have an interest in selling equipment that will result from the BPS requirements, should not the real gains be based on third party, long term (at least 12 months) data to document both efficiency gains through an operating year as well as identify reliability issues. This data should also present capital cost data as well as effect of the technologies listed on operating and electrical usage (pressure drop). I would suggest that this long term operating data be presented required for the technologies listed below to verify the technology is sound and the results can be sustained over long time periods.
    - For conventional economizers, performance is typically about 70 F approach at full load. At 20% load the approach is at best about 20 F. This means about 5X more surface area is required to achieve a 20 F approach at full load. For example for a normal economizer the full load stack temperature is 300 F, to reduce to 260 F this would require 5X the surface area for a efficiency gain at 3% stack O2 of 1.2%. Although this is possible, does it make sense for a 1.2% gain? Is there any data to support long reliable term operation of an economizer of this size? For this low an approach temperature how much does the performance fall off as the tubes get dirty. What is the trade off in cost, pressure drop and fan size versus thermal efficiency savings. Based on long term operating data with a 20 F approach design economizer how much out of service time is expected versus a conventional economizer. What problems have been experienced with a 20 F approach design economizer.
    - What long term operating data is available to support operation of a two stage economizer in a variety of plant operating conditions. How large does each stage of the economizer become to achieve stack temperatures no more than 20 F above the inlet water temperature? What is the trade off in pressure drop and fan size versus thermal efficiency savings. For each plant you need to look at what pressure steam is available for the DA tank. If you heat the water too much in the first stage, high pressure steam may be required for the DA tank instead of low pressure steam negating efficiency advantages. How will these sometimes very complex issues be handled in the permit review.

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2. The second major area where we question the approach in the BPS, is the restriction on FGR and/or stack O2 without any restrictions on other components of the system including the pressure drop through the burner. Although high FGR rates do increase fan horsepower, so can SCRs, high pressure drop burner/boiler designs, heat recovery equipment (economizers and air heaters). Why does the BPS restrict one component of a boiler system that can increase fan horsepower but ignore the other components. For example, if you have a conventional burner operation at 40 ppm NOx with 10% FGR, but the burner is designed for a 16" WC drop with 10% excess air and 10 % FGR and the boiler is designed for a 12" drop the total system pressure drop is 28" WC and the flow is 1.1x1.1 = 1.21. The fan horsepower required is then proportional to 1.21x28 = 33.9. If you compare this to a burner operating with 40% FGR and 20% excess air with a 6" WC burner drop and a 5" boiler drop the equivalent fan horsepower is 1.2x1.4x11 = 18.4 or only 55% of the pressure required for the high pressure drop burner/boiler operating with low excess air and 10% FGR. SCR pressure drops can vary with design, with typical pressure drops ranging from 1" to 6" WC. Again why does this document address FGR/excess air rates without addressing these other factors that can have a great influence over pressure drop.

Other comments regarding the limitation on FGR and excess air in the BPS are given below.

- Some plants have multiple steam pressure headers and use turbine driven FD fans to drop the pressure from the high pressure header to the low pressure header. This energy is virtually free since if the pressure were not dropped across the turbine it would be dropped through a valve or regulator. Why should these boilers be limited in the amount of FGR/excess air required if it does not affect the overall plant (GHG) emissions?
- Operation at 2% stack O2 (dry) is difficult to maintain without excessive CO emissions. The efficiency saving from 2% to 3% O2 is only 0.2% at a stack temperature of 260 F and is even lower at lower stack temperatures. Can the O2 be 5% at 90% load? Will continuous monitoring and reporting be required? Since during a source test it is unlikely the boiler is operating at 100% firing rate, how will the 2% O2 condition at full load be enforced and what is the purpose if there is no restriction on O2 at say 90% firing rate and boilers rarely operate at full load.
- If the goal is to decrease GHG emissions shouldn't you just be setting standards for maximum FD motor size and perhaps stack temperatures relative to feedwater temperatures. Let industry and vendors figure out how to do it best.
- The district analysis does not account for increased pressure drop from 5X larger economizers, SCR, etc. Why are these factors not included in the analysis. These factors can be significant.
- What savings can be produced by advanced use of plant efficiency and process improvements and/or the use of high pressure boilers and creative use of back pressure turbines. Many boilers have no control or heat recovery from blowdown. Why is this not addressed? These types of improvements would not only reduce GHG from new boilers but potentially from all boilers.

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3. Why does the document not address fan mechanical efficiency? There can be large differences in mechanical fan efficiencies ranging from less than 50% to greater than 80%. Specifying high efficiency fans has much more potential than specifying premium motor usage for reducing fan horsepower.

Why is an air heater, particularly condensing air heaters, rejected as BPS. An air heater does potentially increase NOx but if an SCR is used the NOx can be controlled. Depending on the feedwater temperature the air heater may be a way of obtaining the same or higher efficiency at a lower cost and lower pressure drop than an economizer with a 20 F approach temperature. There is at least one boiler with a conventional economizer, condensing air heater and SCR operating in the Valley with an average efficiency of about 90% (higher in the winter lower in the summer).

Finally there are some inaccurate statements in the BPS.

- On page 15 it is stated "the amount of excess O2 is approximately proportional to the efficiency lost; that is 3% excess O2 means approximately a 3% efficiency drop for the boiler." This is not true since heat is recovered in the boiler and the colder the stack temperature the less the efficiency loss. For example at 300 F stack temperature the efficiency difference from 0 to 3% stack O2 is about 0.7%.
- On page 16 it states " FGR has a negative impact on boiler performance similar to excess air and required substantially more HP to operate". With FGR the energy used to heat the FGR is recycled back to the burner while with excess air the energy used to heat the air goes up the stack. The effect of FGR on the boiler overall thermal efficiency depends on the amount of radiation heat transfer surfaces versus convective. Since FGR reduces flame temperature the radiation heat transfer is less but since the velocity of the flue gas is higher the convective heat transfer is increased. On some boilers you can see a very slight drop in efficiency on others a small increase when FGR is used. The effect is normally very small and normally cannot be measured.
- On page 13 it states, "the use of a 2nd stage economizer is a common practice to further enhance energy recovery". I personally deal with hundreds of gas fired industrial boilers in California and through the US, primarily in the size range 40 to 500 klb/hr steam. In all the boilers I have worked with I have never seen a two stage economizer in use although I see many condensing economizers.

Please let me know if you need further information or wish to discuss any of these points.

Sincerely,

Steven Bortz

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