Russell, some of the below comments are from our chief engineer (Doug Allen) and some are from myself.

Scot Smith

- I have a general concern about the influence of a pilot and the pilot heat release on the results. During the prior testing at JZ in the early 1980's, the pilot heat release was huge compared to the total heat release in the low BTU gas testing. We need to ensure pilot heat release is a known and documented testing point. If the steam tip has 8 times the flow capacity of the same gas at the same pressure and temperature, the number of pilots will need to be established in some manner relative to the flare tip capacity (fewer on the LHTS flare system)
- I need to research it more, but the definition of a stable flame and unstable flame do not seem to line up with what I remember from the CMA or EER testing?
- I am not sure what definition was used to determine the "rated" capacity of the steam and air assisted flare tips. My worry is that definition will be passed on and get incorporated into some EPA standard. I am not aware of any universally accepted definition of the "rated" capacity for a flare tip, as it is very dependent on the exit velocity, available pressure, gas temperatures and compositions, etc. We would recommend this be removed.
- The flare tips have very different rated capacities, and very different gas side exit areas. If there is intended any direct correlation between the two tips being tested, we would strongly recommend to reduce the size of the steam assisted tip that is being used in the testing, from 36 inch down to 24 or 20 inch (match the gas exit area in the LHTS flare tip assembly)
- Proper center steam control will be critical to ensuring proper and viable results.
- Prior flare flame plume sampling used fast response RTD or Thermocouples to ensure the probe was located in the hottest or center of the plume. I see a TC is mounted on the sampling device, but do not see this being used relative to the sample collection device location?
- Physical measurements of the flare tip gas and air and steam flow areas should be made and witnessed to ensure proper velocity calculations.
- Will other burner or incinerator or heater testing in the facility be discontinued during the flare testing? Exhaust from other testing could have some impact on the samples being collected during the flare system testing.
- Is there definitive information on the impact of soot on the measurement devices? Any negative impact or issues?
- Ratio of exit area between the air assisted and steam assisted flare tip do not align with the ratio of the "rated" flow capacities?
- I am trying to understand how it can be assured the various measurement techniques being used are applicable to the same conditions in the plume? From prior testing, it seemed the position of the sample probe was relatively critical to getting good data. What definition or practice is being used to determine WAKE dominate or BUOYANCY dominated measurements? What measurement device / method will take the lead in determining the flare flame type, or proper position for measurement?
- How is the center steam flow controlled or varied during the testing? Are any tests conducted with the center steam turned off?
- There is a drawing of a John Zink flue gas sampling device. I guess am quite surprised the flue gas sampling device was designed and constructed by JZ, as I would not have selected that company as having any expertise in the area of flue gas sampling and extraction. In the CMA testing, and EPA probe was used. Was there any third party check on the sampling device design? What is the calibration / certification procedure for the sampling device?

- The piping and system supplying the flare gases to the air flare and steam flare seem to be small compared to the flare tip diameters. What is being used to ensure there is a uniform flow into the inlet of each of the flare tip assemblies?

Doug Allen

My concerns with this arrangement are as follows:

1. During the "Wake Dominated" data acquisition how will they know they are truly in the center of the exhaust plume?
2. The testing is being done on one size Steam Tip and one size Air Tip only. This will still leave a big open item in question which is "does tip diameter have any effect on the DRD?"
3. When the fuel is changed between high LHV and low LHV the exit velocities being used are not the same. If the intent here is to determine the affect of steam and air assist on the minimum flow rates of a flare should this not be done by varying only one parameter at a time which is the LHV and not the LHV and the exit velocities.
4. The JZ Steam Tip uses a different angle on the steam nozzles that us and probably others so does that affect the results and make them only good for JZ Tips?
5. We have no drawing of the JZ Air Tip to be used it seems to have been left out of Appendix L. I would think that the Air/Gas flow areas and geometric arrangement of the tip has a big impact on efficiency and there is probably no way to correlate the data from their tip to other manufacturer's tips or other styles of Air Tips such as internal tube type.

Thank You,

Scot Smith
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