TCEQ Draft Report Comments

Submitted by Scott Evans, Clean Air Engineering

Note these comment represent my opinion and do not necessarily represent the opinions of any of my clients. Comments are presented in no particular order.

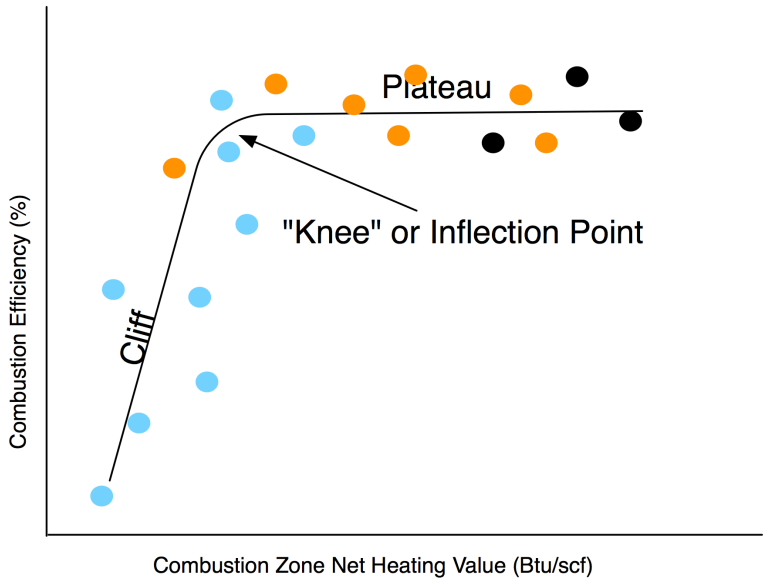
1. General comment use of colloquialism "cliff"

This comment refers to your use of "cliff" or sometimes "shelf" to refer to portions of the flare performance curve. I have no problem with using these colloquial terms, in fact, I think they are a useful shorthand. However, I have two issues with their usage in this report:

a) I don't think they are being used consistently. For example, on Page 89, the term "cliff" seems to be used to represent the "high efficiency" portion of the curve. However, on Page 125 the term "shelf" seems to be used for the same purpose.

b) Those of us who have been doing these flare tests for a while have been using the terms in a different way. We use the term "cliff" to represent the flare performance curve on the "low efficiency" portion of the inflection point. You seem to be using it to represent the "high efficiency" portion. Just to make things consistent, I would suggest you employ the same terminology that has been in informal use for the past few years. Figure 1-1 below shows how these terms have been used in previous reports.

Figure 1-1



2. Page 89: "Steam assist levels currently used by industry would be too high to achieve the desired DRE of 99%"

Response: Recent PFTIR tests have shown two things:

a) Steam based parameters (such as S/VG) are sensitive to vent gas composition (particularly inert concentrations) and/or tip design. Therefore, it is inappropriate to extend any conclusions regarding DRE to S/VG relationships beyond the particular tip and vent gas composition used in this study.

b) Volumetric S/VG (scf/scf) exhibits less variability over a range of conditions and tips than does mass-based S/VG.

See Figures 2-1 through 2-3 below. Note the high efficiency plateau for the Marathon Texas City A test (base load conditions) extends well beyond that found with the TCEQ tests. Similar results can be found with other tests. In fact, the TCEQ test results exhibit the shortest plateau of any test we have seen so far except for the high nitrogen test (Series E) from Detroit. The very short plateaus in these tests have more to do with the high nitrogen content (60-80%) of the vent gas used than with the S/VG. Figure 2-3 shows the data plotted against steam to hydrocarbon ration (S/HC) rather than S/VG. This eliminates the effect of nitrogen. Note that the TCEQ data lines up very nicely with the previous test data.

At least with regard to S/VG plateaus, the TCEQ tests do not appear to be representative of the larger population of flares under normal operating conditions due to the very high nitrogen content of the vent gas. Therefore, the broad conclusion stated above is unwarranted and unsupported.

Figure 2-1

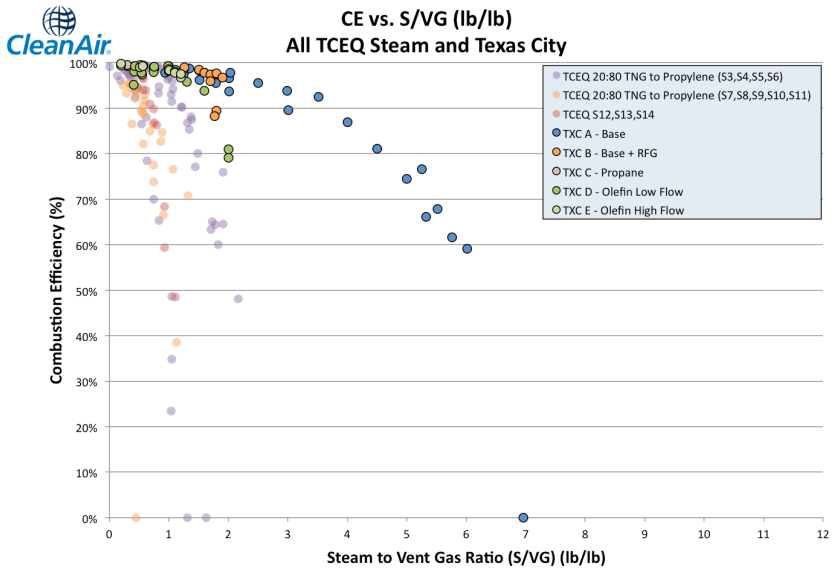


Figure 2-2

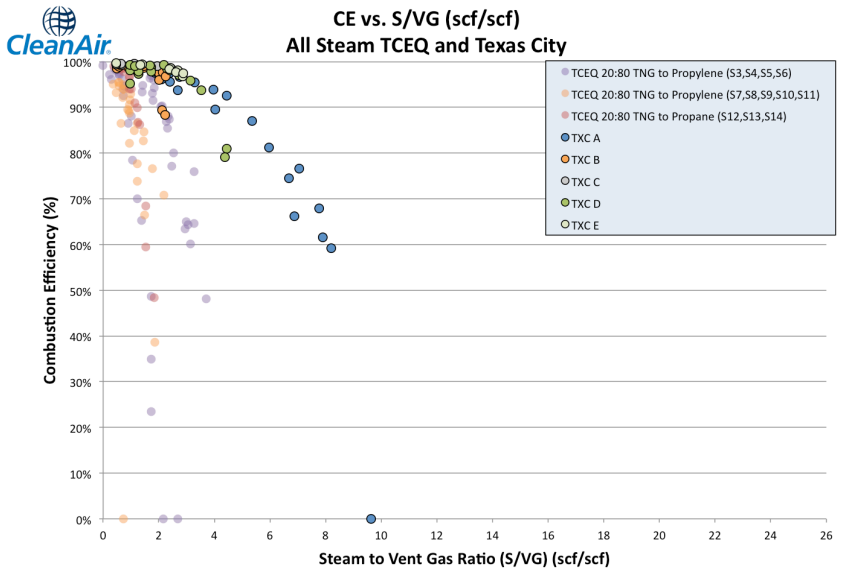


Figure 2-3

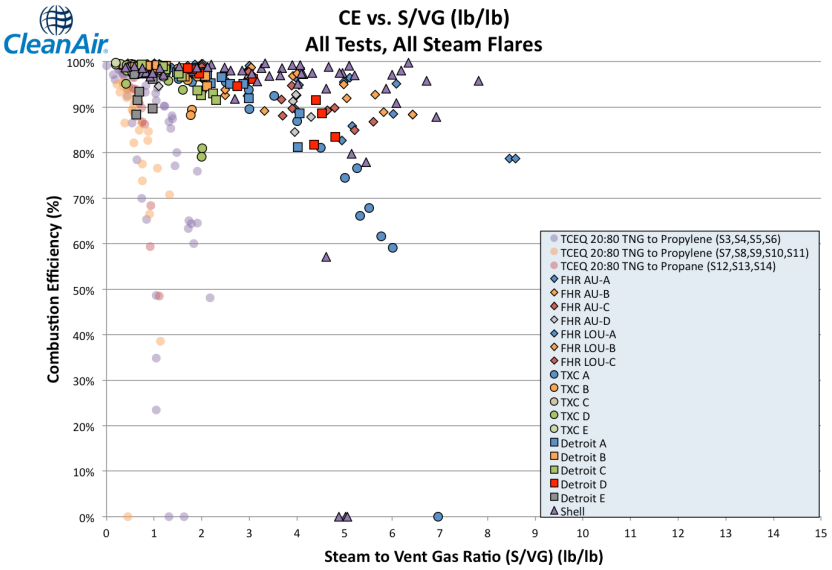
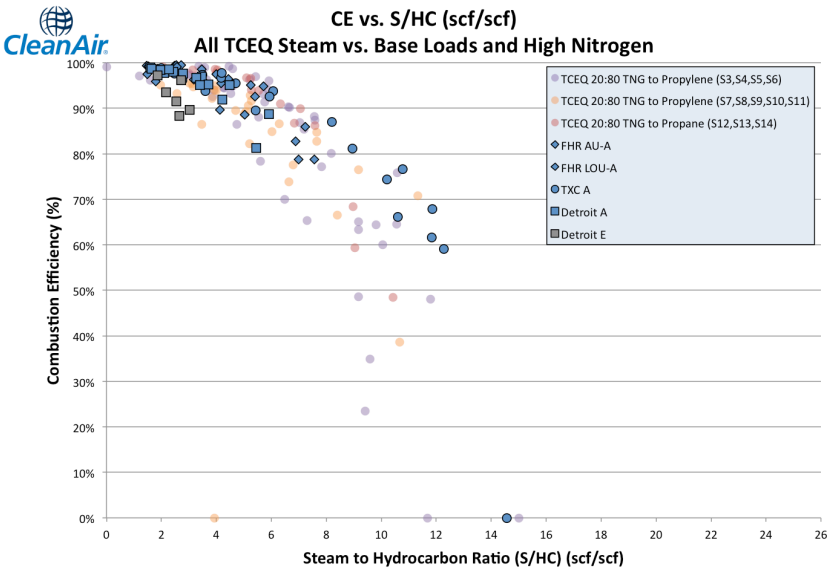


Figure 2-4



3. Page 16 Figure ES-9B and Subsequent

Response: Get rid of the reverse x-axis it is confusing and unnecessary particularly when coupled with the unzoomed version of the chart immediately above.

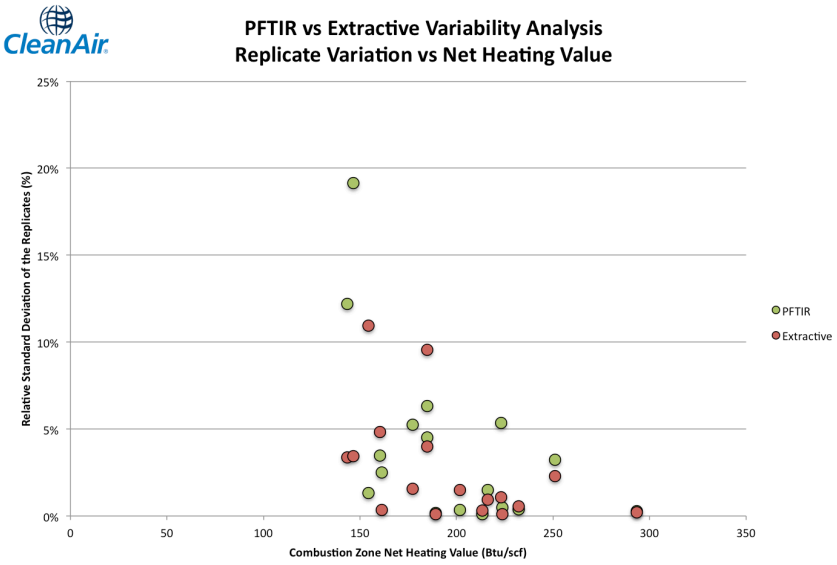
4. Page 110-116 Remote Sensing Comparisons

Response: I think you have gotten enough feedback on this already. These graphs and the table on Page 111 are misleading. The data should not be presented in this way since it implies the Extractive results are "truth" and that all error lies with the remote systems. Figure 4-1 below is an analysis of the variability of both measurement techniques with regard to replicate samples. It demonstrates that both approaches show a similar error pattern of increasing variability with decreasing combustion efficiency.

5. Page 5 PFTIR units

Response: The units listed at the top of Page 5 for the PFTIR are incorrect. The correct units are ppm-meters. Since the optical depth of the flare plume is not known, absolute concentrations cannot be determined by the PFTIR. This is not an issue when calculating combustion efficiency since the units cancel out in that parameter.

Figure 4-1



6. General Comment on Wind Speed Discussion

Response: I don't believe a discussion of the effect of wind speed on flare efficiency can be had without considering at the same time the momentum of the vent gas. High wind speeds with low vent gas momentum may have a different effect on combustion efficiency than high wind speeds with high vent gas momentum. I would suggest using the momentum flux ratio in any discussion of wind effects (see equation). I believe that the amount of upper steam also has an effect and should be taken into account.

$$Momentum\ Flux\ Ratio = \frac{density\ of\ VG \times VG\ velocity^2}{density\ of\ air \times wind\ velocity^2}$$

That's all I have time for now. I would be happy to discuss this report further at your convenience.