

Keith Vugler Response to Questions from Graham Wood of British Gas

1. We are mindful that there is the potential that additional site tests may be required, what is your view on this? We are clear that such a requirement should not be discounted on grounds of cost or inconvenience, due to the value of the error. If further site tests are required then this should be clearly recommended by the ITE.

Yes, I agree that further tests may be required and this potential requirement has been communicated to SGN. I have specifically requested that I be notified of any planned (or otherwise) work activity prior to commencement, to ensure that I am comfortable that it will not affect the integrity of the system from that seen during the SMER period.

2. How were the counter readings verified? You say this was by derived by after the testimony, but how sure are you that this testimony was from true recollection and not a best guess while under the pressure of the interview? This is a critical aspect to establish the exact location of the plate.

I couldn't agree more that the counter readings are a critical aspect of this review. I am still presently exploring different supportive routes for counter position versus site test error.

3. The name plate included a hard to read counter reference and the counters first and last digits were also "clouded" / easily mis-read. So, while in on a scale of 1-100 how confident are you that the "perceived" plate position while in correctly positioned, was what you have presumed: Case 1? Case2?

As stated with my response to item 2 above, I am still reviewing this matter and cannot comment with any definitive "steer" at this stage.

4. The CFD model is questionable in terms of how it is used. We would expect it to be very close to the standard ISO 5167 calculation as this is well defined. However when the plate is not in the correct position it is outside of ISO 5167 so there are no rules or guidance for the calculation. It may therefore need another independent calculation as a check for the first once?

Yes I agree and you are correct in your thoughts. Currently the CFD model shows extremely good correlation to observed flow rates when the plate is “fully racked” and in position (in accordance with ISO 5167). However, once the plate position is simulated outside this position (i.e. the conditions seen during the SMER) the correlation to the site flow test results become less good (as there are many influences at play here). Currently the model exhibits typically a 11% (ish) deviation to that of the site results (at a test point given to the CFD expert for verification purposes). This deviation exhibits a ΔP less than the site tests equating to a larger flow error. I had a meeting with the CFD expert on Tuesday 28th August and we have agreed to focus on some additional areas that may be potentially significant. My view at this stage (if no further progress is made) is to “end” the work association with Professor Malalasekera at Loughborough University and look at potentially another facility to repeat, review and further comment on the whole CFD issue!

5. Is the CFD expert subject to ISO 9001, to include peer review and who was doing that review?

As I understand, Professor Malalasekera is not ISO 9001 accredited. My thoughts were always to have any results “peer reviewed” by a 3rd Party (appropriately accredited) in order to provide complete transparency to the CFD process. Until my response to item 4 becomes clearer, I cannot comment any further on how this will develop.

6. As the CFD results for the “test” point have been unsuccessful so far, how many attempts are you going to give the expert, before this is seen as a “lucky” answer and this line of enquiry no longer progressed?

The CFD expert has been given a single test point (from the 9 points that make up each flow test) for validation purposes. Further to my response to item 4, if he doesn't get “lucky” at this point (and then the other 8) by the end of September, I will look to move forward in another direction.

7. Do the test flows and line conditions match that of the meter run at the time, especially in a cold winter (2010)?

As hopefully I demonstrated to you during my presentation of the 16th July (slide 13 refers), the site tests were performed at the low, medium & high values of pressure and flow rate seen during the SMER period, including the winter period of 2009/2010. The range of temperatures seen during the SMER period ranged between 9 & 14°C and the site testing was typically performed between 9 & 10.5°C.

8. As the pressure loss is far less than expected for the flow rate how is the upstream temperature determined? With ISO 5167 this is clearly defined, but with the plate not in place it can only be assumed, this has an impact as the lack of valid temperature correction will affect the calculated gas density as the upstream temperature has to be determined from an known model with an inconsistent flow profile in the meter run.

Currently my understanding is that the CFD model uses a fixed downstream temperature which is not corrected for the “in error positioning” of the orifice plate because (as you rightly recognise) there is no guidance available to determine a correct value. I have estimated the combined density/flow rate sensitivity of the downstream to upstream correction based on a high flow ΔP of 500

mbar at 62 BarG. Using the ISO 5167:1991 correction that incorporates an isentropic expansion, the effect on flow rate is <0.1% and during “error” flow values this will be reduced even further as the ΔP actually reduces. We know, given the latest temperature correction guidance within ISO 5167:2003 (using an isenthalpic expansion) this effect is even further diminished. Therefore, in my opinion, given the potential SMER errors of typically 30% and 70% this effect of <0.1% is probably best considered 2nd order. I will of course perform some further detailed calculations to support my estimations.

9. The orifice plates removed may also provide evidence but we have not yet seen any photos, are there any that can be shared?

Currently I have copies of the removed orifice plate photographs for 27th August 2010 and 21st July 2009 (key SMER period) and will be requesting the 2011 photographs from SGN when my review necessitates.