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From: Evangelos Marinos
To: Christopher Grimes; Ellis Merschoff
Date: Tue, Nov 9, 2004 8:11 AM
Subject: Re: UFM Bulletin

Sorry, my e-mail response inadvertently did not include the incoming message, so I am resenting it for your convenience.

Ellis,

Given the present circumstances I believe the issues you raised in your e-mail need to be addressed. I did not personally respond, at the time I received your e-mail, because it was understood that the responsibility lied elsewhere for following up on your questions.

1. I fully agree with you that tests performed by Caldon at Reynolds numbers of about 6×10^{-6} are well into the turbulent region. However, they lack the temperature component of the operating plant which is about four times higher than the tested value. At such temperatures the Reynolds numbers are of the order about 20×10^{-6} . This operating condition is important in order to assure that flow coefficients (velocity profile correction factors) are constant and well past the knee-of the curve. Westinghouse on the other hand has conducted numerous tests in laboratory environments and in situ at plant conditions that demonstrate accurately correction factors that match the theoretical curve in the velocity profile.

2. With regard to testing in situ to support the, unwisely, abandoned bulletin, I don't believe every plant needs to be included. A small sample would be adequate, principally for the Caldon instrument which has not been demonstrated at full operating plant conditions.

The in situ tests should resolve the questions raised about the accuracy of the instruments as reviewed and approved by the staff in separate topical report evaluations.

3. Plant configurations are being addressed in the applications where the staff have issued license amendments for UFM's used in power uprate applications.

The UFM's are commissioned with specific plant configurations and correction factors are fixed, bounded by the plant specific uncertainty and alarms are placed on those factors. When configurations are changed causing the correction factor to change beyond the boundary uncertainty, licensees are required to remove the instrument from service and evaluate the conditions.

Both vendors have made a case that adequately addresses plant configuration issues such as those stated in your e-mail (elbows, valves, pumps, etc.).

4. Information I recently obtained from Chris Grimes on ASME publications regarding accuracy of venturi/nozzles, confirms beyond any doubt that flow measurements with those devices, can be very accurate and can adequately assess UFM performance. Dozens of tests have been conducted in various facilities and have consistently demonstrated accuracy between ± 0.2 to $\pm 0.3\%$, which is equal or better than the UFM's.

Westinghouse and some licensees, using the crossflow UFM's, have demonstrated their accuracy by comparisons to venturi/nozzle instrument loops.

>>> Ellis Merschoff 08/04/04 09:46AM >>>
Chris/Angelos,

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During our briefing on the UFM bulletin, the aspect that helped me believe the accuracy of the devices was in question was the different reynolds number/flow conditions between the lab calibration work and the in-situ operating condition.

However, when I plot the actual flow reqimes on a log log Moody Chart, it is clear that the points are all relatively close and well clear of the transition zone, in stable fully developed turbulent flow.

Thus, it is hard to use the argument that the reynolds numbers were not asppropriately matched, even though they vary by as much as an order of magnitude. While my gut tells me it's always a good idea to confirm lab data with real field data, I'm stuggling to find a good engineering basis for insisting that it be done.

Can I assume that our central point now would be the effect of elbows, valves, and specific pump alignments on the in situ application? If yes, how can we accept anything less than testing every plant, or do we think that a sample of plants will show the effect of vortice shedding is not important in fully developed turbulent flow. Has the vendor made that argument?

If I'm missing something here let me know, but I think we're on pretty thin ice with this bulletin.

Ellis

CC: Brian Sheron; Jose Calvo; Richard Barrett