From: Paul Rebstock – PRS
To: Iqbal Ahmed
Date: 10/05/2006 1:24:23 PM
Subject: CrossFlowUFM: Draft Safety Evaluation Withdrawing Acceptance

As a result of my discussions with Warren yesterday and this morning, it is my understanding that the objective of the draft SE is simply to indicate that NRC observes problems with the XFlow device and therefore withdraws acceptance of the associated Topical Report. Discussion of the details of the reason for retracting the previous approval are not to be presented in the SE, although they will probably be addressed in later discussions with Westinghouse that result from the retraction. The explanation of the retraction is to focus upon adverse industry experience, and the SE is not intended to address specific technical questions such as make up the bulk of my comments of Sept28.

It is my understanding that Westinghouse may submit a revised TR, and my detailed comments & questions should be considered in the evaluation of that revised TR.

From this point-of-view, my review of the draft SE should focus only upon the adequacy of the content at the level of detail at which the SE is written. My resulting comments are as follows:

1. The draft SE as written includes a general indictment of the use of laboratory testing. I do not believe that laboratory testing *per se* is in question, but rather the degree to which the laboratory configuration replicates the in-plant conditions. In particular, XFlow is sensitive to the details of the flow profile, and so there must be assurance that the flow profile present in the laboratory is sufficiently similar to the flow profile that will be present in the plant. It appears that the draft SE is intended to challenge the adequacy of this similarity. In our discussion, Warren described various situations in which the laboratory conditions or results were shown to be questionable with respect to the actual plant installation. In my opinion, some of those examples should be presented in support of the claim that laboratory testing has been inadequate.

2. The question of "fully-developed" flow vs "stable" flow does not seem to be adequately addressed. Fully-developed flow is a theoretical condition that may be duplicated in a laboratory as a limiting condition resulting from minimum criteria in the test piping system. The fully-developed flow profile would therefore be repeatable and hence predictable. A stable flow profile means only a profile that does not change under certain circumstances. Since it is not a limiting condition, it depends upon the details of the piping system, and is not necessarily repeatable in a practical sense. Therefore the shape of a merely stable profile is not necessarily known. Since XFlow appears to be sensitive to the details of the flow profile, it is not clear how a profile that is stable but not fully-developed can be adequate unless the testing can be shown to have implemented that same profile. This ultimately gets back to the question of the adequacy of the test configuration in terms of representing the as-installed configuration.

3. A major argument in the draft SE is that the use of XFlow has resulted in documented cases of plants operating beyond their licensed core thermal power limits because FW flow has been underestimated. Since FW flowrate itself is typically a dominant factor in the estimation of core thermal power, the basis for the alternative, and presumably more accurate, estimate of core thermal power should be described.

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4. The discussion of the use of tracer testing for *in-situ* XFlow calibration gives the impression that NRC considers such testing inadequate. It appears from our discussion that the intent was not to question tracer testing itself, but rather to question the adequacy of specific tests that have already been accomplished. It appears that, performed and documented properly, tracer testing is indeed an acceptable approach to *in-situ* flowmeter calibration.

5. My concern over the use of venturis for *in-situ* XFlow calibration remains. Venturis can be highly-accurate devices when calibrated and used properly. The problem that I perceive is that venturis are sensitive to flow profile (although perhaps less so than XFlow). Therefore the use of a venturi to correct for non-ideal flow profiles seems questionable. One would need to show that a venturi is sufficiently insensitive to the degree of deviation of the *in-situ* flow profile from the flow profile present at the time of venturi calibration. Although a venturi may have an uncertainty as low as 0.25% or better in terms of flow vs differential pressure under ideal conditions, the overall accuracy diminishes of as conditions become less than ideal and when the uncertainty in the differential pressure measurement is considered. If the objective is to demonstrate accuracy no better than the venturi and associated instrumentation together can provide at the time of the test, then the venturi-based calibration is acceptable. Whether that level of accuracy is adequate is another question.

6. The use of "online monitoring" by XFlow appears to be for the purpose of monitoring the health of the instrument itself and for monitoring the stability of the fluid conditions. It does not appear to be intended to maintain calibration except in the sense of alarming when conditions appear to be significantly different from what is expected or experienced. The discussion in the SE appears to presume that the point of this monitoring in maintenance of accuracy.

(editorial: In various places, "confidence interval" has been used where "level of confidence" would be correct - the confidence interval is the interval over which the level of confidence is maintained. 4th paragraph of 3.2 uses "affect" where "effect" would be correct.)

CC: Allen Howe; John Nakoski; Warren Lyon

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