From: James Kim
To: Charles.L.Kling@us.westinghouse.com
Date: 8/25/05 9:45AM
Subject: Re: IRIS Test Plan Review Meeting

Chuck,

Attached is Mr. Bessette's review comments on WCAP-16392-P from the thermal hydraulic perspective in support of the upcoming meeting on September 27.

Thanks
Jim Kim

>>> <Charles.L.Kling@us.westinghouse.com> 08/23/05 2:31 PM >>>

Jim/Dave -

Right now 09/27 is acceptable for Westinghouse.

We would appreciate any draft comments ahead of time.

I do not think the meeting will be longer than 2-3 hours.

A late morning or early afternoon start would be preferable to accommodate our travel plans.

I will let you know if we have to make any changes.

Regards,

Chuck

CC: Laura Dudes; Tolani Owusu

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Creation Date:	8/25/05 9:45AM
From:	James Kim
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Review of IRIS Test Plan WCAP-16392-P
David Bessette, RES/DSARE/ARREB

The following is a review WCAP-16392-P from the thermal hydraulic perspective. Not included is a review of Sections 5.1, 5.2.2, 5.2.3, 5.2.6, 5.2.7, 5.3.1, 5.3.3, 5.3.4, and 5.3.7.

The design of IRIS differs considerably from any PWRs that have been designed or built previously. Therefore, from the thermal hydraulic perspective, a comprehensive testing program is order to meet the intent of 10 CFR 52.47 (b)(2)(I) for certification of standard designs.

The program described appears to fulfill that requirement. The report describing the testing program is well organized an well written. It is expected that as the test plans develop, a greater level detail will be provided for the relevant facilities. Specific comments follow.

1. The steam generator secondary side inventory appears to be small relative to U-tube steam generators. This may make the plant more sensitive to feedwater flow transients, although this may be mitigated by the large vessel volume.

2. The top of containment is removed for refueling. The sealing system to be used during refueling should be described to ensure plant protection from shutdown accidents.

3. What is the reason for having a separate ADS quench tank as opposed to routing the ADS discharge to the suppression pool (the explanation on page B-5 of WCAP-16318 does not seem fully satisfactory)? Figure 2-3 from WCAP-16392-P differs from WCAP-16318-P Figure 4.3-1. The Plant Description Document does not refer to a quench tank at all. Why six tanks and not one? It would be helpful to have a figure similar to 2-3 available drawn roughly to scale.

4. Do the systems functions of the EHRS include station blackout? Since it has four 100% trains, would all four open on a normal signal?

5. The instrumentation requirements and instrumentation plan should be described according to the phenomena identified in the PIRT, as well as information needed to qualify CFD and systems codes. This is not required for the current report.

6. Section 3.7 should also include mention of energy balance.

7. Section 3.8 should consider qualitative and quantitative conclusions regarding code-data comparisons.

8. Section 3 should identify data sets planned to be transmitted to NRC, in contrast to information generated for product development or for other internal use.

9. Section 5.2-1. This appears to be primarily a product development program. From the Staff's thermal hydraulic perspective, this test program appears to be subsumed by the larger scale tests.

10. Section 5.2.4. Small scale EHRS heat exchanger heat transfer tests appears to be a product development series. Testing of the final design at larger scale under Table 4-4,

EHRS and SG Integrated Tube Performance, is of more interest. Recall that the small scale PRHR heat exchanger tests performed for AP600 were of limited value.

11. Section 5.2.5. It is not clear that the design of the reactor coolant pumps allows for a flywheel. The design basis loss of pumped flow accident will need to consider the flow coast down effects on DNB. The RCPs will be pumping water that is at T_{hot} rather than T_{cold}. The tests and/or analysis should ensure adequate NPSH.

12. Section 5.2.8. The test and instrumentation plan would appear to be of particular interest. Presumably, these tests will be accompanied by CFD analysis.

13. Section 5.2.9. See comment above regarding loss of flow transient. Will DNB testing include transient flow conditions in addition to the usual steady state to simulate flow coast down?

14. Section 5.3.2. A rationale will be needed to justify the scale size selected. Will flow induced vibration of the helical steam generator tubes be studied in this test series or another? The test range should extend to beyond anticipated full flow conditions to see whether the design approaches a flow vibration condition, as well as the possibility of future power uprates. It would appear that the tests should include the prototypic layout of the RCP just upstream of the steam generator entrance, or otherwise explain why this configuration is not required.

15. Section 5.3.5. The instrumentation plan that would provide sufficient data to benchmark the CFD calculations is of interest.

16. Section 5.3.6. It is not clear how the system design prevents continuous flow into the upper head/pressurizer region in order to avoid excessive mixing with the vessel volume proper. No particular comment on these tests.

17. It would seem that the objectives of this test can be incorporated into the integral test program to obviate the need for a separate facility.

18. This facility will be the main focus of interest in the overall thermal hydraulic testing program. Consideration should be given to reduced height "Ishii Scaling" approaches to obtain a more favorable aspect ratio in the vessel as well as reduced heat loss. APEX, for example, achieved prototypic heat loss, whereas SPES was highly distorted.

It may be advisable to include in the testing program parametric ranges that would cover all conceivable possible power uprates. This would also provide information on design margin. Given the low linear heat generation rate currently envisaged, final thermal power rating could end up to be ~2000 MWt.

<u>WCAP-16392-P</u>

As background to the review of WCAP-16392-P, the PIRT report was briefly reviewed as well.

It appears that too many phenomena may be ranked high, flow resistance for example. Past evaluations of small break LOCAs have shown that there are only a few highly ranked phenomena as long as the core remains covered. It is recognized that this was the first effort to establish an IRIS PIRT, therefore, there may have been a bias towards overrating phenomena where there was uncertainty amongst the PIRT panel members. No specific comments on the PIRT rankings are offered at this time.

1. The focus on the two break sizes is appropriate. Additional analyses may show that only the DVI break is limiting. On the other hand, perhaps station blackout should have included.

2. Table 2-1, Phase II. How is it that the steam generators do not fill with noncondensables and lose heat transfer entirely?

3. The natural circulation modes of IRIS should resemble a B&W plant. As inventory decreases, there will be an interruption of natural circulation and heat removal until inventory drops below the top of the steam generators. Then it will resume in the boiler condenser mode. Natural circulation modes are not mentioned.