AP1000DCDFileNPEm Resource

From: Buckberg, Perry
Sent: Friday, October 23, 2009 11:23 AM
To: Loza, Paul G.
Cc: McKenna, Eileen; Sisk, Robert B.
Subject: OI-SRP 9.3.6-SRSB-01 (AP1000 SER Chapter 9 Open Item)

Paul,

Since the Chapter 9 ACRS meeting is approaching, it's a good time to discuss one of the Chapter 9 OIs that has ACRS interest. Below is some background and specific questions related to addressing the subject OI that we would like to discuss in a telephone conference (next week?).

In Revision 17 of the AP1000 DCD, zinc addition is discussed as an option in Section 9.3.6.2.3.3. The detailed technical evaluation of zinc addition is contained in APP-GW-GLN-002 (TR32) Revision 0. The staff reviewed several reports documenting industry experience with zinc addition in PWR's, which indicate that there is no concern with crud deposition for plants with low-duty or medium-duty cores (Reference 1, 2). However, there is currently insufficient operating experience with zinc addition in plants with high- duty cores to be able to conclude whether zinc injection could cause a problem with crud deposition in such plants. Potential problems with crud deposition could include excessively thick fuel crud, or uneven crud thickness that could lead to crud induced power shift (CIPS), also known as axial offset anomaly (AOA). Reference 2 recommends a fuel surveillance program for high-duty plants implementing zinc addition. Plants with high-duty cores are those with high fluid temperatures and high surface heat flux at the fuel clad causing a portion of the total heat transfer to the coolant to occur by sub-cooled nucleate boiling (SNB). Although favorable for thermal efficiency, the combination of high temperature and SNB leads to more severe duty on the fuel, and surface boiling is known to enhance the formation of corrosion product deposits (crud) at the cladding surface. The High Duty Core Index (HDCI) is a measure of the duty on a core and is defined in Appendix F of Reference 3. Cores with an HDCI of ≥ 150 are considered to be high duty plants, medium duty plants have HDCI of 120-149, and a plant with HDCI ≤ 119 is considered a low-duty plant. **<u>It is not clear to the staff whether the AP1000 core is considered a high-duty core</u>.**

In the response to RAI-TR32-007, the applicant provided data on measured oxide thickness from 12 fuel surveillance campaigns from operating reactors, which showed no significant difference in oxide thickness for plants with and without zinc. TR-32 indicates that there are oxide thickness measurements for one high-duty plant. However, Reference 2 indicates that there has been relatively little experience with zinc addition at high duty plants through 2006.

TR-32 states that:

> "The results of oxide thickness measurements including a high-duty plant indicate that zinc does not have a statistically significant effect on cladding corrosion. This will be reconfirmed in cycle-specific reload analyses."

<u>It is not clear to the staff how cycle-specific reload analyses would confirm that zinc would not have a significant effect on cladding corrosion</u>.

<u>Specifics to discuss related to OI-SRP 9.3.6-SRSB-01</u>:

1. Is the AP1000 core design as described in DCD Revision 17 considered a high-duty core?
2. If the AP1000 is considered a high-duty core design, how will it be assured that there will not be problems with excessive crud buildup or uneven crud buildup in operating AP1000 plants? This answer may

necessitate either operating experience that demonstrates that a fuel surveillance program is unnecessary, or a recommendation for a fuel surveillance program to be implemented (COL Item).

3. Explain how cycle-specific reload analyses would confirm that zinc would not have a significant effect on cladding corrosion.
4. Since one of the objectives of zinc addition is to reduce the potential for CIPS, will an evaluation of CIPS potential be performed as part of the cycle-specific reload analysis? If so, provide details of the evaluation and a relative comparison to operating plants with and without CIPS. Also, since zinc injection will initially increase the reactor coolant Ni concentration, explain in detail the zinc injection strategy to be employed to minimize the CIPS potential.

References

1. Overview Report on Zinc Addition in Pressurized Water Reactors—2004, 1009568 Final Report, December 2004, Electric Power Research Institute
2. Pressurized Water Reactor Primary Water Zinc Application Guidelines 1013420 Final Report, December 2006, Electric Power Research Institute
3. PWR Axial Offset Anomaly (AOA) Guidelines, Revision ,1008102, Final Report, June 2004, Electric Power Research Institute

Thanks,

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Hearing Identifier: AP1000_DCD_Review
Email Number: 298

Mail Envelope Properties (44CD2E65B0FF0E499CB32BC30CF781F069D6E161)

Subject: OI-SRP 9.3.6-SRSB-01 (AP1000 SER Chapter 9 Open Item)
Sent Date: 10/23/2009 11:22:42 AM
Received Date: 10/23/2009 11:22:00 AM
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