ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Friday, October 15, 2010 11:11 AM
To: 'usepr@areva.com'
Cc: Ashley, Clinton; Jackson, Christopher; McKirgan, John; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 434 (4897), FSAR Ch. 6
Attachments: RAI_434_SPCV_4897.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 6, 2010, and discussed with your staff on September 24, 2010. No changes were made to the draft RAI as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2136

Mail Envelope Properties (0A64B42AAA8FD4418CE1EB5240A6FED12195631AA9)

Subject: U.S. EPR Design Certification Application RAI No. 434 (4897), FSAR Ch. 6
Sent Date: 10/15/2010 11:10:43 AM
Received Date: 10/15/2010 11:10:44 AM
From: Tesfaye, Getachew

Created By: Getachew.Tesfaye@nrc.gov

Recipients:
"Ashley, Clinton" <Clinton.Ashley@nrc.gov>
Tracking Status: None
"Jackson, Christopher" <Christopher.Jackson@nrc.gov>
Tracking Status: None
"McKirgan, John" <John.McKirgan@nrc.gov>
Tracking Status: None
"Carneal, Jason" <Jason.Carneal@nrc.gov>
Tracking Status: None
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>
Tracking Status: None
"ArevaEPRDCPEm Resource" <ArevaEPRDCPEm.Resource@nrc.gov>
Tracking Status: None
"'usepr@areva.com'" <usepr@areva.com>
Tracking Status: None

Post Office: HQCLSTR02.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	776	10/15/2010 11:10:44 AM
RAI_434_SPCV_4897.doc	48122	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information No. 434(4897), Revision 0

10/15/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.02 - Containment Heat Removal Systems
Application Section: 6.3

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

06.02.02-69

Follow-Up to RAI 310, Question 06.03-14 and RAI 363, Question 06.02.02-43:

US EPR FSAR Tier 2, Section 6.3.3.3 “NPSH Evaluation” states the SIS pump NPSH evaluation for LBLOCA events is performed using the maximum pump flow head-capacity curves. The response to RAI 310, Question 06.03-14, indicates the design basis maximum flow through one sump is 3447 gpm (MHSI and LHSI combined flow). In the response to RAI 363, Question 06.02.02-43, the flow through the sump used for strainer qualification is 3284 gpm. It appears that strainer qualification flow does not bound the design basis maximum flow. Therefore, provide a detailed discussion of AREVA's approach to selecting the plant ECCS flow rate used for strainer qualification and justify the described approach.

06.02.02-70

Follow-up to RAI 111, Question 06.02.02-8E4:

The NRC safety evaluation report on NEI 04-07 guidance report discusses “miscellaneous debris” and provides a method the staff finds acceptable for evaluating this debris source. AREVA debris generation analysis assumes 100 ft^2 and 50 lbm of “miscellaneous debris”. For the 100 ft^2 assumption, it is not clear how AREVA applied this assumption to the screen area as part of their analysis and qualification testing. For the 50 lbm, AREVA deviates from guidance (i.e. fiber assumption) and did not justify the approach. Both of these “miscellaneous debris” issues impact qualification testing. The staff requests that AREVA justify their method and approach to “miscellaneous debris” in comparison to guidance and explain how qualification testing incorporates debris generation analysis “miscellaneous debris” assumptions.

06.02.02-71

Follow-up to RAI 363, Question 06.02.02-43 item 11:

Analysis of the most challenging postulated accident with regard to sump performance during long-term core cooling involves selection of the most limiting pipe break size, location, and debris combination within containment. RG 1.82 position C.1.3.2.3 states that a sufficient number of breaks in each high pressure system that relies on recirculation should be considered. The NEI 04-07 GR states that the objective of the

break selection process is to identify the break size and location which results in debris generation that produces the maximum head loss across the sump screen.
For the US EPR, ANP-10293 indicates there are two main paths for debris to enter the IRWST and potentially transport to the sump strainer. The two main paths for debris to enter the IRWST are from the heavy floor and the annular floor. The flow from these floors is filtered by debris interceptors called retaining baskets. Flow from the heavy floor to the IRWST is filtered by a large basket. Flow from the annular floor to the IRWST is filtered by a small basket.

The retaining basket performance is critical for analyzing and measuring strainer performance because the basket is designed to capture debris and keep it from reaching the strainer. However, the basket can overflow and as a result, debris can bypass the retaining basket and transport to the strainer. Therefore, in order to assess what causes the maximum head loss across the sump screen, a complete understanding of basket performance is necessary. Since the maximum head loss for US EPR is determined by testing, it is important to evaluate the performance of each debris flow path to the IRWST and their associated debris interceptors (retaining baskets).

AREVA's analysis and testing approach to date has focused on the large retaining basket. In RAI 363, Question 06.02.02-43 item 11, AREVA was asked how the small compartment retaining basket was bounded by testing for the large compartment retaining basket. In a June 17, 2010, phone call discussing this question and AREVAs response, AREVA indicated that the small compartment retaining basket no longer receives water from the annular floor due to a design change that redirected pressurizer room break flow from the annular floor to the heavy floor. It was also mentioned that the annular floor will only receive water from condensation and it will not fill up and spill into the small compartment basket located in the IRWST. Because this information is not be docketed and has not been fully explained , the staff requests AREVA to document the assessment of whether pipe breaks (consistent with RG 1.82 and NEI 04-07 guidance) can deliver water and/or debris to the annular floor. Provide a listing of potential systems that were considered and why they can or cannot deliver water to the annular region. If they can, then assess the impact on small basket performance and strainer head loss (debris generation, debris transport, and debris accumulation). As part of the discussion clearly define the purpose of the small retaining basket and document this discussion in ANP-10293.

In addition, the staff request that AREVA provide a complete assessment of the annular floor region and its water hold-up capacity in response to a design basis accident that requires recirculation. Include in the discussion the annular region water sources (pipe break, condensation), how high the water level can rise in the annular region, what limits the height of the water level in the annular region, identify any compartment(s) into which the water from the annular region spills , and describe any components (dampers, valves) that need to actuate/function/operate in order to allow the annular region to spill into another compartment (e.g. IRWST). If condensation is the sole source of water collecting in the annular region, describe the method and approach used to assess the amount of condensate that could collect in the annular region.

06.02.02-72

Follow-up to RAI 111, Question 06.02.02-8, and RAI 233, Question 06.02.02-29 Regarding Upstream Effects and water hold-up:

Upstream effects and water holdup is an important aspect of Generic Safety Issue (GSI) 191 and NEI 04-07, especially where curbs or weirs or flooding berms are used to hold up debris and water. In RAI 111, Question 06.02.02-8 responses, AREVA provides a discussion of the US EPR upstream effects and provides water hold-up information in the Supplement 4 response to RAI 233, Question 06.02.02-29. This information is an important design detail to support resolution of GSI-191 upstream effects and water hold-up. However, minimal upstream effects and water hold information is provided in the FSAR. In addition, ANP 10293 Rev 1, "US EPR Design Features to Address GSI-191", assesses the US EPR design with respect to NEI 04-07 and RG 1.82 but provides a limited discussion on upstream effects and water holdup. The staff requests that AREVA document their upstream effects and water hold-up evaluation in ANP-10293 or the FSAR and include a summary of design information such as a table listing hold-up volumes and their location (floors, steam, condensate, trapped in compartments etc.).

06.02.02-73

ANP-10293 Rev. 1 Figures E.6-2, E.6-4 includes a note indicating basket head change due to flume water evaporation. Given that testing employed water level management controls (make-up and letdown), it is not clear why evaporation was a factor. Explain the reasons behind AREVAs conclusion that the head loss change was related to evaporation and not other causes. In the response, include any other test impacts or test observations associated with evaporation.

06.02.02-74

The U.S. EPR debris generation analysis uses a 2.4D zone-of-influence (ZOI) for assessing the amount of fiber insulation generated during the accident. This ZOI is for steel jacketed Nukon (fiber insulation) with Sure-Hold bands based on NEI 04-07 GR and NRC SE Table 3-2. The 2.4D ZOI was derived from testing for a specific insulation system. Therefore, in order to apply the 2.4D ZOI, the U.S. EPR fiber insulation system, fasteners, and associated components should be of a design that is equivalent or more robust than the tested Sure-Hold system (the BWROGs air jet impact testing is described in Volume 3 of the BWROGs Utility Resolution Guidance). Important design features of the testing include band spacing, pipe diameter, band fasteners, band width, jacket overlap (axial and circumferential), jacket material and thickness, etc. The staff requests that AREVA evaluate if their design specific application of the 2.4D ZOI is bounded by existing testing, with specific consideration given to differences in pipe diameters between the test and U.S. EPR design and minimum radius requirements for the fasteners. For those piping applications that are not bounded, the staff request that AREVA provide additional analysis or ITAAC to support the debris generation analysis (fiber insulation source term derived by application of a 2.4D ZOI). In addition, to assess the sensitivity of the U.S. EPR source term to the ZOI size, assuming that the 2.4D ZOI was increased to 17D (as listed in the NRC SE value corresponding to unjacketed Nukon or jacketed Nukon with standard bands), estimate how much additional fibrous insulation debris would be generated using break locations listed in ANP-10293 Rev. 1 Appendix C.

06.02.02-75

Follow-up to RAI 111, Question 06.02.02-8:

FSAR Tier 2, Section 1.8 and 6.3.2.2.2 describe COL item 6.3-1 “A COL applicant that references the U.S. EPR design certification will describe the containment cleanliness program which limits debris within containment”. Revision 1 to FSAR Tier 2, Section 6.3.2.2.2 provides additional information on what is included in the U.S. EPR containment cleanliness program such as permanent and temporary modifications, foreign material, conduct of maintenance, and coatings but does not discuss latent (resident) and miscellaneous debris. Explain how and where latent and miscellaneous debris are included in the cleanliness program as described in the FSAR. What specific latent debris limits or controls does the U.S. EPR design establish to enable the COL applicant to remain within the containment cleanliness program design basis limits? What specific miscellaneous debris limits or controls does the U.S. EPR design establish to enable the COL applicant to remain within the containment cleanliness program design basis limits? Explain why these design basis limits or performance criteria (i.e. lbm of latent debris and area assumed for miscellaneous debris) are not contained within the COL cleanliness program description in FSAR section 6.3.2.2.2?

06.02.02-76

Follow-up to RAI 111, Question 06.02.02-8:

In the Supplement 10 response to RAI 111, Question -6.02.02-8K6, AREVA indicated that fluid from a pressurizer surge line break reaches the pressurizer relief tank (PRT) room and is released through a door separating the PRT room and steam generator blowdown (SGBD) room. Flooding berms, associated with SGBD room doors and doorways, are mentioned as design features that prevent flooding of the annular space and serve to contain the fluids within the SGBD and PRT rooms. Also, wall openings are provided at four locations to route fluid out of the SGBD room and into the loop areas of the heavy floor.

Given that four openings are now provided to connect the SGBD room to the loop area heavy floor, describe the impact during a large break LOCA where fluid spills onto the loop area heavy floor. Will fluid from a break in the loop area flood the SGBD and PRT rooms? How is this volume considered in the water hold-up analysis? Describe the design of the four SGBD room wall openings and any devices installed at the opening that are required to actuate to permit/block fluid flow to/fm the loop area of the heavy floor through these openings. Also, describe how floor openings, wall openings, berms and doors permit fluid and debris, generated during a break near the pressurizer, to flow into and out of the PRT room and SGBD room (include assessment of break selection, debris generation, debris transport and upstream effects (water hold up or choke points) and provide details of debris types and quantities evaluated). In addition, provide a simple figure or discussion about where and how water is held up and how high a level is reached in the PRT and SGBD rooms in response to a pressurizer surge line break and a break in the loop area. Discuss height of curbs, openings, and flooding berms, and how doors are used to either release or contain water. A discussion of these important design features to address GSI-191 is expected to be included in technical report ANP-10293 or an appropriate FSAR Section.

06.02.02-77

Follow-up to RAI 111, Question 06.02.02-8 K10:

In the Supplement 10 response to RAI 111, Question 06.02.02-8 K10, AREVA made several qualitative statements and staff requests additional information to support or justify these statements.

The first statement is the amount of LOCA water reaching the annular space is minimal because the water reaching the annular space is essentially condensation from released steam. Explain how this conclusion was reached. What model is used to estimate the amount of water collected due to condensation that supported reaching a conclusion that the amounts were minimal? How much water is collected? Also, define what is meant by minimal and assess if the inventory of condensate in the annular region is sufficient to cause an overflow into the IRWST.

The second qualitative statement is a "limited" amount of latent debris can be transported to the annular space from condensation effects. What is the basis that supports this conclusion and what is the amount considered. The third qualitative statement is the effects of a small amount of latent debris reaching the retaining basket from the annular area are bounded by favorable test results. Define what is meant by small amounts reaching the basket in GSI-191 terms such as debris source term assumptions and debris transport assumptions. Also, explain how the tested basket (large basket) bounds the basket serving the annular region (small basket) given that they have different source terms, areas, heights etc.

06.02.02-78

Provide the density of latent particulate material and justify its selection in comparison with guidance

06.02.02-79

The retaining basket and strainer head loss testing for US EPR was designed to assess debris accumulation on the basket and strainer screens. During the July 2010 strainer test, after all the non-chemical particulate and fiber was added, the staff noted a potentially significant floating layer of fibrous debris, covering a large portion of the test tanks water surface. The staff was surprised by the amount of floating fibrous debris in the test. Based on observation, it appears that air bubbles generated by the impingement of the recirculation system jet and entrained in the water flow were interacting directly with debris to create floating masses.

The staff also noted that the test protocol and scaling were intended to conservatively or prototypically represent the fluid dynamic conditions at the screen and basket faces. The phenomena that are pertinent to debris floating do not appear to have been scaled conservatively or prototypically. For example, the test temperature was lower than in the plant, the debris concentrations were higher than in the plant, and the distances between the screens and the impingement of the recirculation jet were generally much shorter. Therefore, the staff requests AREVA to evaluate the impact on strainer head loss if the floating fibrous debris had transported/accumulated on the strainer and address the following questions:

What are the principal phenomena that would contribute to debris floating? Where these phenomena modeled conservatively or prototypically in the test? Explain why it is acceptable for the test to permit floating as a debris removal mechanism given how the principal phenomena were scaled.