ArevaEPRDCPEm Resource

From: Tesfaye, Getachew
Sent: Monday, October 05, 2009 5:22 PM
To: 'usepr@areva.com'
Cc: Honcharik, John; Terao, David; Hearn, Peter; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 294 (3758), FSAR Ch. 10
Attachments: RAI_294_CIB1_3758.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 18, 2009, and on the October 5, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The questions in this RAI are considered potential open items for Phases 2 and 3 reviews. As such, the schedule we have established for your application assumes technically correct and complete responses prior to the start of Phase 4 review. For any RAI that cannot be answered prior to the start of Phase 4 review, it is expected that a date for receipt of this information will be provided so that the staff can assess how this information will impact the published schedule.

Thanks,
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Hearing Identifier: AREVA_EPR_DC_RAIs
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Request for Additional Information No. 294 (3758), Revision 1

10/5/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 10.02.03 - Turbine Rotor Integrity
Application Section: 10.2.3

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

10.02.03-17

POTENTIAL OPEN ITEM

In response to RAI No. 100, Question 10.02.03-1, the applicant responded that the COL applicant will procure a turbine that meets or exceeds the FSAR bounding specifications, or provide suitable justification for the departure. The staff notes that the FSAR does not provide applicable material specifications for procuring the turbine rotors and, therefore, the staff requests that the applicable material specifications be included in the FSAR in order to determine if the chemical composition (i.e., limiting trace elements, etc.) will improve fracture toughness, along with any operating experience of these materials. In addition, the description of the procedures used to minimize flaws, improve toughness, and minimize chemical segregation should be discussed as requested in the above RAI.

10.02.03-18

POTENTIAL OPEN ITEM

In response to RAI No. 100, Question 10.02.03-4, the applicant responded that the specific method to calculated fracture toughness properties of the turbine rotor from material properties tests will be identified by the COL applicant upon selection of the specific rotor design. The staff finds this acceptable, since the COL applicant will provide the specific method of calculating the fracture toughness properties depending upon the specific rotor design. However, the COL Information Item 10.2-5 in the FSAR should be revised to specify that the method of calculating the fracture toughness properties of the turbine rotor material should be provided.

10.02.03-19

POTENTIAL OPEN ITEM

In response to RAI No. 100, Question 10.02.03-6, the applicant replied that the high pressure part of the high/intermediate pressure (HIP) rotor assembly is one forged section. The intermediate pressure part of the HIP rotor assembly consists of three forged sections. The HIP rotor assembly is a welded rotor consisting of the four forgings. The rotors of the low pressure turbine are a welded rotor design. Based on this information, the HIP rotor assembly consists of four forged pieces welded together.

However, it is not clear whether the LP rotor consists of forged pieces and the number of pieces. Therefore, the staff requests clarification of the LP rotor, including a sketch. The HIP should also be included in the sketch to understand the arrangement of the turbine rotors, including all weld locations for HIP and LP, and their accessibility for inspection.

10.02.03-20

POTENTIAL OPEN ITEM

The applicant's response to RAI No. 100, Question 10.02.03-6, provided that, since these are weld rotors, keyways are not used as in shrunk-on turbine rotor discs. However, in response to RAI No. 100, Question 10.02.03-8, the applicant stated that holes are drilled for the pins used to fix the moving blades to the turbine rotors. These holes are drilled once the blades are assembled to the turbine rotor and, therefore, a surface examination is not performed. However, to account for not performing a magnetic-particle or liquid penetrant examination of the holes, the turbine missile analysis will account for this by considering a potential initial defect in the turbine rotor at the zero point. In addition, ultrasonic examination is performed on the forged pieces. Also, there are no finished bores in this turbine design. Based on this information, the staff needs the following information to determine whether the integrity of the turbine rotor can be determined prior to service:

a. Confirm this is a solid cored rotor (non-bored). If this is the case, provide the following:

    1. Discuss the method for obtaing, for the non-bored rotor, 100 percent ultrasonic inspection in accordance with the FSAR Tier 2, Sections 10.2.3.5 and 10.2.3.6, since there is no bore to gain access to perform the ultrasonic inspection.

    2. Typically, each fabricated rotor has destructive testing performed at various locations to ensure homogeneity and acceptable material properties. Justify that the material properties for each rotor fabricated will have the required material properties and homogeneity throughout the forged rotor, including the interior, which is normally bored out. Also, provide any supporting evaluations or tests.

b. Confirm that ultrasonic testing is performed on the forged parts after the holes are drilled. Also confirm that this inspection can detect defects at the hole region to account for not performing a magnetic-particle or liquid penetrant examination of the holes so that no flaws are allowed in the keyway and hole regions as specified in SRP 10.2.3 guidance.

c. Clarify the term "zero point" in your response to RAI No. 100, Question 10.02.03-6, and in the turbine missle analysis discuss accounting for not performing a magnetic-particle or liquid penetrant examination of the holes. Also, provide a COL information item addressing that the COL applicant's turbine missile analysis will account for not performing a magnetic-particle or liquid penetrant examination of the holes by considering a potential initial defect in the turbine rotor.

10.02.03-21

POTENTIAL OPEN ITEM

In response to RAI No. 100, Question 10.02.03-9, the applicant stated that each specific turbine missile analysis is a function of the selected turbine and, therefore, is a COL applicant-provided analysis. Once a specific turbine design has been selected, the COL applicant provides a design-specific turbine missile analysis as required by the ITAAC Item Nos. 1a and 1b in FSAR Tier 1, Table 2.8.1-3. Therefore, the applicant considers that the turbine rotor inservice inspection program is correctly described in the FSAR Tier 2, Sections 10.2.3.6 and 10.2A.3.6, and associated ITAAC. The NRC staff notes that Section 10.2A.3.6 did specify that the COL applicant will provide the inspection program. However, Section 10.2A has been deleted, since an alternate turbine design will not be used. However, FSAR Tier 2, Section 10.2.3.6 for the standard turbine design only requires that the COL applicant provide the inspection interval, not the inspection program (which includes the types of inspections, extent of inspections, acceptance criteria, and inspection intervals). Therefore, the NRC staff requests that COL Information Item 10.2-5 for the standard turbine design in Table 1.8-2 of the FSAR Tier 2, be revised to state the inspection “program” and “interval” to ensure the COL applicant, submits the required information for the staff to review during the COL review.

10.02.03-22

POTENTIAL OPEN ITEM

In response to RAI No. 100, Question 10.02.03-9, the applicant replied that volumetric examination is not a standard inservice inspection, but it is performed if any indications are identified during visual and surface examination. The staff notes that visual and surface examination does not provide 100 percent volumetric inspection of the turbine rotors to ensure that defects such as cracks are discovered prior to reaching critical crack size, (which is determined from the turbine missile analysis) and thereby potentially compromising the integrity of the turbine rotor and ultimately resulting in turbine missile generation. The staff also notes that ultrasonic inspection of turbine rotors is a standard inservice inspection and is referenced in other FSAR applications and in the guidelines of SRP Sections 3.5.1.3 and 10.2.3. Therefore, the staff requests that ultrasonic inspection of the turbine rotors be included in the inservice inspection program described in FSAR Tier 2, Section 10.2.3.6.

10.02.03-23

POTENTIAL OPEN ITEM

In response to RAI 100, Question 10.02.03-10, the FSAR Tier 1 was revised in Revision 1 to clarify Table 2.8.1-3 by having ITAAC commitments 1.0a and 1.0b. In response to RAI 100, Question 10.02.03-11, the FSAR Tier 1 was revised in Revision 1 to clarify ITAAC commitment 1.0a to include that the acceptance criteria for the as-built turbine material property data, rotor and blade design, and preservice testing and inspection meet the requirements of the turbine missile probability analysis. However, the staff notes that ITAAC commitment 1.0a should apply to the "as-built turbine rotor," and the ITAAC should be revised accordingly.