REQUEST FOR ADDITIONAL INFORMATION 274-2126 REVISION 1

3/11/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 05.04.01.01 - Pump Flywheel Integrity (PWR)
Application Section: 5.4.1.1

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

05.04.01.01-1

US-APWR DCD, Revision 1, Tier 2, FSAR Section 5.4.1.1.2 states that all cut surfaces are removed by machining to a depth of 1/2 inch minimum below the cut surface to minimize any loss of fracture toughness during fabrication. However, this FSAR Section does not discuss the guidance in RG 1.14, "Reactor Coolant Pump Flywheel Integrity," on the prohibition of welding, including tack welding and repair welding unless the welds are inspectable and considered as potential sources of flaws in the fracture analysis. Therefore, this FSAR Section should discuss how the guidance in RG 1.14 on prohibiting welding will be addressed for the US-APWR flywheel design.

05.04.01.01-2

RG 1.14 states that past evaluations have shown that ASME Code, SA-533, Grade B, Class 1 and SA-508 Classes 2 and 3 materials generally have suitable toughness for typical flywheel applications, provided stress concentrations are kept within reasonable limits and the reference nil-ductility transition temperature (RT_{NDT}), determined in accordance with Article NB-2331(a) of Section III to the ASME Code, is at least 50°C (90°F) below the lowest temperature at which operating speed is achieved. Discuss how the RT_{NDT} value of the material procured for the flywheel will meet these guidelines in RG 1.14.

05.04.01.01-3

RG 1.14, Section C.4.a states that following the spin test, each finished flywheel receives a check of critical dimensions, and a non-destructive examination. The non-destructive examination includes surface examination of areas of high stress concentrations using procedures in accordance with NB-2540, and acceptance criteria in NB-2545 or NB-2546 of Section III to the ASME Code, and a 100 percent volumetric examination using procedures and acceptance criteria specified in accordance with NB-2530 or NB-2540 of Section III to the ASME Code. Revise the DCD to provide the following information in sections 5.4.1.1.1 and 5.4.1.1.2 to address the above guidance in RG 1.14. Provide a copy of the revised sections and specify in which revision of the DCD the changes will appear.

a) Specify that the surface and volumetric examinations will be performed after the spin test so that any flaws that have initiated or grown during the spin test can be detected.
b) Specify that the flywheel will be inspected for critical dimensions after the spin test so that any dimensional changes can be detected.
c) Specify what the inspection procedures will be qualified to, and include the acceptance criteria.

05.04.01.01-4

The US-APWR DCD, Revision 1, Tier 2, FSAR Section 5.4.1.1.1 references Mitsubishi Heavy Industries, Ltd. Report, MUAP-07035, Revision 0, which addresses the evaluation of the critical speeds for failure modes of ductile facture, non-ductile fracture, and excessive deformation. Section 2.0 of the Mitsubishi Heavy Industries, Ltd. Report, MUAP-07035, Revision 0, provides the physical design and dimensions of the flywheel. This section also states that there is an upper flywheel, and includes dimensions. However, there is no mention of a lower flywheel or its dimensions. Therefore, the staff requests that the following be provided:

a) Clarify whether there are two flywheels, or if there is one flywheel fabricated by bolting two steel discs together.
b) Clarify whether Figure 2-1 is the entire flywheel assembly, or part of the flywheel assembly.
c) Provide the thickness of the flywheel.
d) Discuss what machining radius is used when manufacturing the keyways in the flywheel, in order to reduce the stress concentration in these areas, since section 3.0 ignores local stress concentrations in the keyways.

05.04.01.01-5

The Mitsubishi Heavy Industries, Ltd. Report, MUAP-07035, Revision 0, provides a fatigue crack growth that was determined from the crack growth rate in Appendix A of Section XI to the ASME Code. An initial crack length of 0.50 inches was assumed, with an assumed loading cycle of 3000 starts and stops for a 60 year plant life. A crack growth of 0.039 inches was calculated. However, the critical crack size is needed to determine if the fatigue crack growth of a missed flaw for the inspection interval will still met the critical crack size criteria of the ASME Code. Therefore, provide the allowable crack length for the flywheel using the criteria of Section XI of the ASME Code, and discuss what crack length and depth the current ultrasonic examination techniques can detect.

05.04.01.01-6

US-APWR DCD, Revision 1, Tier 2, FSAR Section 5.4.1.1.1 states that the flywheel is tested at 125 percent of maximum synchronous speed of the motor. US-APWR DCD, Revision 1, Tier 1, Section 2.4, Table 2.4.2-5 provides an ITAAC commitment No. 10.b, which requires that the as-built reactor coolant pump flywheel assembly be tested at 125 percent of operating speed. The ITAAC is provides the necessary information for the

flywheel spin test to be performed, including the acceptance criteria. However, the staff notes that SRP Section 5.4.1.1, Part II, SRP Acceptance Criteria, paragraph 3.D, states that the preservice inspection results, which are performed after the spin test, should be appropriately documented to establish the initial flywheel conditions, accessibility and practicality of the inspection program to be used as baseline information for future inservice inspections. Therefore, the ITAAC should address how the preservice inspection results of the as-built flywheel assembly will be documented.

05.04.01.01-7

US-APWR DCD, Revision 1, Tier 2, FSAR Section 5.4.1.1.2 states that the inservice inspection program of the flywheel is based on the guidelines of RG 1.14, and the ASME Code, Section XI. The inspection program is further discussed in US-APWR DCD, Revision 1, Tier 2, FSAR Section 16, Technical Specification (TS) 5.5.7, "Reactor Coolant Pump Flywheel Inspection Program." TS 5.5.7 in US-APWR DCD, Revision 1, Tier 2, FSAR Section 16 states that the reactor coolant pump flywheel inspection program is per the recommendations of Regulatory Position C.4.b of RG 1.14, Revision 1. However, TS 5.5.7 further states that in lieu of Regulatory Position C.4.b(1) and C.4.b(2), a qualified in-place ultrasonic examination over the volume from the inner bore of the flywheel to the circle one-half of the outer radius or a surface examination (magnetic particle and/or liquid penetrant) of exposed surfaces of removed flywheels may be conducted at 20 year intervals. Since this does not meet the guidelines of RG 1.14, the staff requests that justification be provided for the proposed inspection option. In addition, provide justification for making the inspection intervals at 20 years, which differs from the guidance in RG 1.14 and the SRP in Section 5.4.1.1, Subsection II, SRP Acceptance Criteria 6.B.