

REQUEST FOR ADDITIONAL INFORMATION 265-2172 REVISION 1

3/9/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 05.04.02.01 - Steam Generator Materials

Application Section: 5.4.2

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

05.04.02.01-1

Section 5.4.2.1.2.3 of the DCD identifies the steam generator tube material as thermally treated Alloy 690 and states that a special thermal treatment is applied after full solution mill annealing. According to DCD Table 5.2.3-1, the specification for the tubing is ASME SB-163. Since ASME SB-163 does not address the thermally treated condition, please discuss the specifications and controls that will be in place to ensure the thermal treatment will produce the type of microstructure that has performed well in Alloy 690 steam generator tubes in operating reactors.

05.04.02.01-2

Please identify the total thickness of the steam generator tubesheet and how much of the total thickness is the SFA 5.14 primary-side weld cladding.

05.04.02.01-3

Section 5.4.2.1.2.3 of the DCD states the "smaller radius" U-bends receive a thermal stress-relief treatment to reduce residual bending stresses and thereby reduce susceptibility to corrosion (including stress corrosion cracking). Please identify the rows that will receive this thermal treatment and the basis for selecting these rows.

05.04.02.01-4

For the Alloy 690 steam generator tubing, Section 5.4.2.1.2.8 of the DCD states no corrosion allowance will be applied. Given that the Code requires components to be thick enough to account for all forms of degradation (e.g., corrosion, erosion, wear), please discuss the basis for including no corrosion allowance in the design.

05.04.02.01-5

Please identify in the DCD the chromium content specified for the low-alloy steel components in the steam generators. For carbon steel components, will a minimum

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chromium content be specified to enhance the resistance to flow accelerated corrosion? If so, please identify this chromium content in the DCD.

05.04.02.01-6

The Code requires that Class 1 and Class 2 components subject to forms of degradation that cause thinning (e.g., corrosion, erosion, wear) be thick enough to account for the degradation over the design or specified life of the component. This is stated in Code Section III, paragraphs NB-3121 and NC-3121 for Class 1 and Class 2 components, respectively. According to Table 5.4.2-3 of the DCD, the corrosion allowance will be 0.060 inch for the tubesheet secondary side, secondary side pressure boundary surfaces, and carbon and low-alloy steel secondary side internals. Please provide the following additional information about these corrosion allowances:

- a) Does the corrosion allowance include an allowance for external corrosion of the SG shell? If not, explain the basis.
- b) Do the corrosion allowances include allowances for other mechanisms such as wear or erosion? If not, please discuss how you determined that no allowance is required for these thinning mechanisms.

05.04.02.01-7

Please discuss the corrosion allowances specified for stainless steel components (e.g., the primary nozzle safe ends, steam generator internals) and the basis for the specified corrosion allowance.

05.04.02.01-8

What are the materials for the feedwater ring thermal sleeve and perforated nozzles? What is the alloy specification (i.e., Cr and Mo) for the low alloy steel used for the feedwater ring? Section 5.4.2.1.2.11 indicates there has been no water hammer in operating plants with this design. Please discuss the operating experience for this feedwater ring design with respect to other areas of concern, such as degradation of the ring or nozzles, or experience with loose parts entering the steam generator tube bundle.

05.04.02.01-9

DCD Section 5.4.2.1.5 refers to "the latest version of the industry guidelines" without identifying the guidelines. It does not appear that the APWR plant intends to commit to EPRI Water Chemistry Guidelines, since Table 1.9.2-5 of the DCD states the US APWR specifications for secondary-side water chemistry are, "almost consistent with EPRI Guideline." The staff notes that consistency with Branch Technical Position (BTP) 5-1 (which DCD Section 5.4.2.1.5 states adherence to) should include an explanation of how the plant meets industry guidelines such as EPRI Secondary Water Chemistry Guidelines and NEI 97-06. Please discuss your plans to identify in DCD Section 5.4.2 the industry guidelines for the primary and secondary water chemistry programs.

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05.04.02.01-10

Sections 5.4.2.1.6 and 5.4.2.2.1 of the DCD describe the steam generator openings that provide access for cleaning and inspection. Please provide the sizes of these openings.

05.04.02.01-11

Considering recent operating experience with divider plate cracking, please discuss the safety significance of divider plate cracking and how the design of the US APWR steam generators addresses this issue.