US-APWRRAIsPEm Resource

From: Ciocco, Jeff
Sent: Tuesday, April 30, 2013 3:03 PM
To: us-apwr-rai@mhi.co.jp; US-APWRRAIsPEm Resource
Cc: LaVera, Ronald; McCoppin, Michael; Otto, Ngola
Subject: US-APWR Design Certification Application RAI 1027-7093 (12.3 & 12.4)
Attachments: US-APWR DC RAI 1027 RPAC 7093.pdf

MHI,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, MHI requests and we grant 60 days to respond to the RAI. We will adjust the schedule accordingly.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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REQUEST FOR ADDITIONAL INFORMATION 1027-7093

Issue Date: 4/30/2013

Application Title: US-APWR Design Certification - Docket Number 52-021

Operating Company: Mitsubishi Heavy Industries

Docket No. 52-021

Review Section: 12.03-12.04 - Radiation Protection Design Features
Application Section: 12, 6, 9

QUESTIONS

12.03-56

In RAI 532-4019 Question 12.02-29, the staff asked the applicant to provide information about the design features of structure housing the Refueling Water Storage Auxiliary Tank (RWSAT), including the ventilation controls for the facility. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012, stated that the tank house does not include a ventilation system. There is no stated method of controlling temperature in the RWSAT in either the US-APWR DCD Revision 3, or the response to RAI 532-4019 Question 12.02-29. Since the US-APWR DCD Revision 3 does not describe the design features provided to minimize the potential generation of extra radioactive waste or increased facility contamination resulting from damage to RWSAT by freezing of the contents, it is not clear to the staff how the design of the RWSAT is consistent with the guidance contained in RG 4.21 for meeting the requirements of 10 CFR 20.1406.

Please revise and update the US-APWR DCD to include a description of the design features provided to prevent damage to the RWSAT structure due to freezing of the RWSAT contents, or provide the specific approaches used and the associated justification.

12.03-57

In RAI 532-4019 Question 12.02-29, the staff asked the applicant to provide information about the design features of structure housing the Refueling Water Storage Auxiliary Tank (RWSAT), including the ventilation controls for the facility. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012, stated that the tank house does not include a ventilation system. US-APWR DCD Revision 3 Subsection 9.3.4.2.1 "Reactor Coolant System Inventory Control, Reactor Coolant Pump Seal Injection and Makeup," states that when a low-low Volume Control Tank (VCT) level alarm is actuated, the charging pump suction is switched from the VCT to the RWSAT. Standard Review Plan (SRP) section 9.3.4 "Chemical and Volume Control System (PWR) (Including Boron Recovery System)," states that all components and piping that can contain boric acid will either be heat traced or will be located within heated rooms to prevent precipitation of boric acid. US-APWR DCD Revision 3 Table 6.1-3 "Water chemistry Specifications of the Refueling Water Storage Pit (RWSP)," states that the boron concentration for the RWSP will be maintained between 4,000 and 4,200 ppm. Subsection 6.3.2.2.3 "Refueling Water Storage Pit," states that the purification subsystem described in DCD Subsection 9.1.3, is designed to maintain the chemistry of the RWSAT. US-APWR DCD Revision 3, Table 9.1.3-1 "Recommended Spent Fuel Pit Water Chemistry

Speciation," states that Spent Fuel Pit (SFP) boron concentration will be maintained greater than 4,000 ppm. DCD Table 9.3.2-6 "Process Grab Sample Points," states that a local sample point is provided to ascertain RWSAT boron concentration, but does not specify an allowable range of boron concentration in the RWSAT water. While there is no discussion a the allowable boron concentration in the RWSAT, since the water in the RWSAT may be mixed with sources of water containing boric acid at or above 4,000 ppm, it would be possible for the water in the RWSAT to contain boric acid at or above 4,000 ppm. The allowable temperature range of water in the RWSAT is not discussed in DCD Chapters 6, "Engineered Safety Features," or DCD Chapter 9 "Auxiliary Systems." DCD Chapters 6, "Engineered Safety Features," does not contain any related system configuration or design information, other than tank volume, for the RWSAT. The solubility of boron in water at 0 ºC is only 2,520 ppm.

Please revise and update the US-APWR DCD to include a description of the design features provided to prevent boric acid precipitation within the RWSAT and in the line leading to the charging pump suction from the RWSAT, or provide the specific approaches used and the associated justification.

12.03-58

US-APWR DCD Revision 3 Subsection 9.1.3.2 "System Description," states that to maintain adequate water level in the spent fuel pool (SFP), excess pit water is discharged into the refueling water storage pit (RWSP) or to the refueling water storage auxiliary tank (RWSAT) by using the spent fuel pit (SFP) pumps discharging through the SFP system purification loop. US-APWR DCD Revision 3 Subsection 9.1.3.3.2 "Spent Fuel Pit Water Supply," states that a makeup water connection is provided to compensate for the water lost to natural evaporation from the SFP, however, there is no stated maximum boron concentration for the SFP, so as a result of evaporation, the boric acid concentration in the SFP could exceed 4,200 ppm. While there is no discussion about the allowable boron concentration in the RWSAT, since the water in the RWSAT may be mixed with sources of water containing boric acid at or above 4,000 ppm, it would be possible for the water in the RWSAT to contain boric acid at or above 4,200 ppm. Neither US-APWR DCD Revision 3 Chapter 6, "Engineered Safety Features," or US-APWR DCD Revision 3 Chapter 9 "Auxiliary Systems." describe the provisions for reducing boron concentration to less than 4,200 ppm in the RWSAT. Since the configuration of the SFP purification and cooling systems allows for mixing water between the RWSAT, SFP and RWSP, it is possible that the maximum allowable boric acid concentration in the RWSP could be exceeded. The process of reducing the boron concentration of the RWSP would generate additional radioactive waste that is inconsistent with the guidance contained in RG 4.21.

Please revise and update the US-APWR DCD to include a description of the design features provided to reduce the concentration of boric acid in the RWSAT to below 4,200 ppm prior to mixing with the contents of the RWSP, or provide the specific approaches used and the associated justification.

12.03-59

In RAI 532-4019 Question 12.02-29, the staff asked the applicant to provide information about the design features of structure housing the Refueling Water Storage Auxiliary Tank (RWSAT), including the ventilation controls for the facility. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012, stated that the tank house does not include a

ventilation system. Revision 3, Table 9.1.3-1 “Recommended Spent Fuel Pit Water Chemistry Speciation,” states that Spent Fuel Pit (SFP) boron concentration will be maintained greater than 4,000 ppm. DCD Table 9.3.2-6 “Process Grab Sample Points,” states that a local sample point is provided to ascertain RWSAT boron concentration, but does not specify an allowable range of boron concentration in the RWSAT water. While there is no discussion about the allowable boron concentration in the RWSAT, since the water in the RWSAT may be mixed with sources of water containing boric acid at or above 4,000 ppm, it would be possible for the water in the RWSAT to contain boric acid at or above 4,000 ppm. The allowable temperature range of water in the RWSAT is not discussed in DCD Chapters 6, “Engineered Safety Features,” or DCD Chapter 9 “Auxiliary Systems.” The solubility of boron in water at 0 ºC is only 2,520 ppm. US-APWR DCD Revision 3 Subsection 9.3.4.5.4.1” Volume Control Tank Level,” states that if the water level in the VCT decreases a low-low level signal opens the stop valves in the refueling water storage auxiliary tank supply line, and closes that VCT outlet stop valves. Low RWSAT temperature and boron concentrations greater than 2,520 ppm could result in boron precipitation within the Reactor Coolant Pump (RCP) Seal Injection Filters that could challenge the integrity of the RCP seals, and thus the Reactor Coolant System pressure boundary, through either the loss of seal injection flow or from the introduction of debris from the seal injection filters exposed to a high differential pressure.

Please revise and update the US-APWR DCD to include a description of the design features of the RWSAT and the supply line to the charging pump suction provided to ensure the integrity of the RCP seal and seal injection filters, or provide the specific approaches used and the associated justification.

12.03-60

In RAI 532-4019 Question 12.02-29, the staff asked the applicant to provide information about the design features of structure housing the Refueling Water Storage Auxiliary Tank (RWSAT), including the ventilation controls for the facility. The applicant’s response to RAI 532-4019 Question 12.02-29 dated July 10 2012, stated that the tank house does not include a ventilation system. Revision 3, Table 9.1.3-1 “Recommended Spent Fuel Pit Water Chemistry Speciation,” states that Spent Fuel Pit (SFP) boron concentration will be maintained greater than 4,000 ppm. DCD Table 9.3.2-6 “Process Grab Sample Points,” states that a local sample point is provided to ascertain RWSAT boron concentration, but does not specify an allowable range of boron concentration in the RWSAT water. While there is no discussion a the allowable boron concentration in the RWSAT, since the water in the RWSAT may be mixed with sources of water containing boric acid at or above 4,000 ppm, it would be possible for the water in the RWSAT to contain boric acid at or above 4,000 ppm. The allowable temperature range of water in the RWSAT is not discussed in DCD Chapters 6, “Engineered Safety Features,” or DCD Chapter 9 “Auxiliary Systems.” Standard Review Plan (SRP) section 9.3.4 “Chemical And Volume Control System (PWR) (Including Boron Recovery System),” states that all components and piping that can contain boric acid will either be heat traced or will be located within heated rooms to prevent precipitation of boric acid. US-APWR DCD Revision 3 Figure 9.3.4-1 “Chemical and Volume Control System Flow Diagram (Sheet 4 of 7),” shows the line from the RWSAT to the charging pump suction, but does not indicate if any or all of that line is equipped with heat tracing. The solubility of boron in water at 0 ºC is only 2,520 ppm. Precipitation of boric acid within the line between the charging pump suction and the RWSAT could obstruct the line resulting in charging pump damage.

Please revise and update the US-APWR DCD to include a description of the design features of the RWSAT and the supply line to the charging pump suction provided to ensure the line between the charging pump suction and that RWSAT will not be obstructed by precipitated boric acid, or provide the specific approaches used and the associated justification.

12.03-61

The allowable temperature range of water in the RWSAT is not discussed in DCD Chapters 6, "Engineered Safety Features," or DCD Chapter 9 "Auxiliary Systems." US-APWR DCD Revision 3 Subsection 9.3.4.5.4.1" Volume Control Tank Level," states that if the water level in the VCT decreases a low-low level signal opens the stop valves in the refueling water storage auxiliary tank supply line, and closes that VCT outlet stop valves. A Low-low VCT level that result in use of the alternate RWSAT supply may be due to a loss of letdown flow. Since there is no discussion in the DCD regarding the temperature of the water in the RWSAT, water at temperatures as low as 0 ºC, may be pumped from the RWSAT through the regenerative heat exchanger, possibly resulting in high thermal stresses within the regenerative heat exchanger, that could challenge the integrity of the heat exchanger.

Please revise and update the US-APWR DCD to include a description of the design features of the RWSAT and the Chemical and Volume Control System (CVCS) system that thermal stresses within the Regenerative Heat Exchanger would remain acceptable, thus ensuring the integrity of the regenerative heat exchanger, when using the RWSAT as an source of water for the charging pump suction, or provide the specific approaches used and the associated justification.

12.03-62

In RAI 532-4019 Question 12.02-29, the staff asked the applicant to provide information about the design features of structure housing the Refueling Water Storage Auxiliary Tank (RWSAT), including the ventilation controls for the facility. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012, stated that the tank house does not include a ventilation system. The allowable temperature range of water in the RWSAT is not discussed in DCD Chapters 6, "Engineered Safety Features," or DCD Chapter 9 "Auxiliary Systems." Revision 3, Table 9.1.3-1 "Recommended Spent Fuel Pit Water Chemistry Speciation," states that Spent Fuel Pit (SFP) boron concentration will be maintained greater than 4,000 ppm. DCD Table 9.3.2-6 "Process Grab Sample Points," states that a local sample point is provided to ascertain RWSAT boron concentration, but does not specify an allowable range of boron concentration in the RWSAT water so the concentration of the boric acid solution in the RWSAT is unknown, US-APWR DCD Revision 3 Chapter 15 "Transient and Accident Analysis," does not discuss the potential impact on Reactor Coolant System reactivity due to the injection of low temperature, potentially low boron concentration water, from the RWSAT as a result of a low-low VCT level alarm.

Please revise and update the US-APWR DCD to include a description of the design features of the RWSAT provided to ensure that the analysis provided in US-APWR DCD Revision 3 Chapter 15, continues to bound a potential injection into the Reactor Coolant System of low temperature, low boric acid concentration water via one or more charging pumps using water from the RWSAT, or provide the specific approaches used and the associated justification.


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