US-APWRRAIsPEm Resource

From: Ciocco, Jeff
Sent: Tuesday, April 30, 2013 3:16 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 1028-7094 (12.3 & 12.4)
Attachments: US-APWR DC RAI 1028 RPAC 7094.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,

Jeff Ciocco
US-APWR Projects
New Nuclear Reactor Licensing
301.415.6391
jeff.ciocco@nrc.gov

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Created By: Jeff.Ciocco@nrc.gov

Recipients:
"LaVera, Ronald" <Ronald.LaVera@nrc.gov>
Tracking Status: None
"McCoppin, Michael" <Michael.McCoppin@nrc.gov>
Tracking Status: None
"Otto, Ngola" <Ngola.Otto@nrc.gov>
Tracking Status: None
"us-apwr-rai@mhi.co.jp" <us-apwr-rai@mhi.co.jp>
Tracking Status: None
"US-APWRRAIsPEm Resource" <US-APWRRAIsPEm.Resource@nrc.gov>
Tracking Status: None

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REQUEST FOR ADDITIONAL INFORMATION 1028-7094

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

12.03-63

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) and the Primary Makeup Water Tank (PMWT), provided to minimize contamination of the facility and the environment, consistent with the guidance in RG 4.21 and the requirements of 10 CFR 20.1406. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10, 2012 stated that the PMWT venting line is connected to the Auxiliary Building HVAC system, as shown on Figure 9.2.6-2 "Primary Makeup Water System Flow Diagram," and that minimizes the potential for venting into the tank house. US-APWR DCD Revision 3, Subsection 9.2.6.2.6 states "Two 140,000 gallon capacity PMWTs are provided and that each tank is provided with a diaphragm that is in continuous contact with the tank water to prevent absorption of oxygen from air. The top of the diaphragm is blanketed with deaerated, demineralized water." Figure 9.2.6-2 shows the vent to the HVAC from the non-radiological (top) side of the diaphragm. The applicant's response to RAI 532-4019 Question 12.02-29 contains Figure A-2 "Detail of Cross Sections of the Tank House," section illustrations for the PMWT and the RWSAT show overflow lines from the tanks. The applicant has not committed to adding Figure A-2 to the DCD. However, neither of the illustrations on Figure A-2 have any information about siphon/vacuum breakers that may open into the building. The PMWT overflow line shown on Figure A-2 appears to originate at the bottom of the tank. Based on the experience of the staff, there is usually some type of siphon protection provided for overflow lines, but neither DCD Figure 9.2.6-2 nor the PMWT illustration on Figure A-2 contain this information, so it is not clear to the staff that the design of the PWMT prevents airborne contamination within the building from the PMWT contents due to water in the overflow line venting into the tank house building. Since the tank house building does not have any active ventilation system, any leakage and subsequent evaporation into the enclosed space could result in elevated airborne radioactive contaminants, including tritium.

Please revise and update the US-APWR DCD Subsection 9.2.6 and subsection 12.3, to describe the design features provided to prevent airborne contamination in the tank house build from the overflow line of the PMWT, or provide the specific alternative approaches used and the associated justification.

12.03-64

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) and the Primary Makeup Water Tank (PMWT), provided to minimize contamination of the facility and the environment, consistent with the guidance in RG 4.21 and the requirements of 10 CFR 20.1406. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10, 2012, stated that the high radiation water used for refueling will not be directly transferred to the RWSAT and also contained proposed changes to DCD Subsection 9.1.4.2.2.2 "Reactor Refueling Operations," which described the processes and systems to be used for water related to sources of water used for refueling. The applicant's response committed to changing DCD subsection 11.2.2.1.2.3 "Maintenance/Refueling Operations," to state that during refueling, the containment vessel reactor coolant drain pumps are used to drain water from the reactor coolant loops to the holdup tank. However, the applicant's proposed changes to DCD Subsection 9.1.4.2.2.2 "Reactor Refueling Operations," does not include the statement contained in DCD subsection 11.2.2.1.2.3, to drain water from the loops to the holdup tanks. Neither Subsection 9.1.4.2.2.2 nor Subsection 11.2.2.1.2.3 include the statement in the RAI answer discussion that high radiation water used for refueling will not be directly transferred to the RWSAT. The applicant's response also stated that the new DCD Figure 9.1.4-4 "Outline of Refueling Water Storage System," provided in the RAI response, was an overview of the Refueling Water Storage System including the RWSAT. Based on the system configuration provided in the proposed Figure 9.1.4-4, high radiation water could be transferred directly from the reactor coolant system to the RWSAT without passing through the spent fuel pool demineralizers.

Please revise and update the US-APWR DCD subsection 9.1.4.2.2.2, to include information about the destination of water from the RCS loops or other sources of high radiation water, or change the system configuration depicted on Figure 9.1.4-4 so that this water must go through the Spent Fuel Pit (SFP) demineralizers prior to entering the RWSAT, or provide the specific alternative approaches used and the associated justification.

12.03-65

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) and the Primary Makeup Water Tank (PMWT), provided to minimize contamination of the facility and the environment, consistent with the guidance in RG 4.21 and the requirements of 10 CFR 20.1406. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012, contained proposed changes to DCD Subsection 9.1.4.2.2.2 "Reactor Refueling Operations," "Phase IV - Reactor Assembly," describing how water located in the refueling cavity and fuel transfer canal is handled at the conclusion of refueling. The subsection states that most of the refueling cavity water is transferred to the Refueling Water Storage Pit (RWSP) by the CS/RHR pump. The water in the lower level of the reactor vessel flange is transferred to the RWSP by gravity. The water in the transfer canal is removed by using the transfer canal pump to transfer the water in the transfer canal is to the Spent Fuel Pit (SFP). The water in the SFP from the transfer canal is then transferred to the Refueling Water Storage Auxiliary Tank (RWSAT) through the SFP demineralizer and the SFP filter by the SFP pump. However US-APWR DCD Revision 3 Figure 9.1.4-2 "Section View of Light Load Handling System," shows a space below the refueling cavity side of the fuel transfer tube that would not be emptied by use

of the SFP transfer canal pump, and the applicant's proposed changes to DCD Subsection 9.1.4.2.2.2 "Reactor Refueling Operations," "Phase IV - Reactor Assembly," does not contain a description of how this area will be drained and the water cleaned prior to storage. Also, US-APWR DCD Revision 3 Figure 9.1.3-1 "Schematic of Spent Fuel Pit Purification and Cooling System (Cooling Portion)," and Figure 11.2-1 "Liquid Waste Processing System Process Flow Diagram," do not show a drain line for this portion of the refueling cavity transfer canal area. Based on staff operating experience, the water remaining around the refueling cavity transfer canal area may contain radioactive material corrosion and wear products. US-APWR DCD Revision 3 Subsection 12.3.1.3 "Minimization of Contamination and Radioactive Waste Generation," does not contain a discussion of how this area will be drained or how the radioactive material that may accumulate in this area will be removed.

Please revise and update the US-APWR DCD subsection 9.1.4.2.2.2 and subsection 12.3.1.3, to include information about the destination of water and radioactive corrosion and wear products, from the refueling cavity fuel transfer canal area, or provide the specific alternative approaches used and the associated justification.

12.03-66

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) and the Primary Makeup Water Tank (PMWT), provided to minimize contamination of the facility and the environment, consistent with the guidance in RG 4.21 and the requirements of 10 CFR 20.1406. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012, the applicant's proposed changes to DCD Subsection 9.1.4.2.2.2 "Reactor Refueling Operations," "Phase IV - Reactor Assembly," states that most of the refueling cavity water is transferred to the Refueling Water Storage Pit (RWSP) by the CS/RHR pump and that the water in the transfer canal is transferred to the Spent Fuel Pit (SFP) by the transfer canal pump and then the water in the SFP is transferred to the RWSAT by the SFP pump via SFP demineralizer and the SFP filter. US-APWR DCD Revision 3 Subsection 6.2.2.2.1 "CS/RHR Pumps," states that the pumps are sized to deliver 3,000 gpm at a discharge head of 410 ft. US-APWR DCD Revision 3 Figure 9.1.3-1 Schematic of Spent Fuel Pit Purification and Cooling System (Cooling Portion) shows the CS/RHR pump discharge going to the SFP. DCD Figure 6.2.2-7 "Required Water Volumes vs. Pit Capacities," shows that 29,410 ft3 (~217,000 gallons) of water is transferred to the RWSAT from the refueling canal following an outage. Based on the dimensions of the SFP provided in DCD Figure 9.1.1-2 "Spent Fuel Pit," and the component design parameters specified in Table 9.1.3-3 Spent Fuel Pit Cooling and Purification System Component Design Parameters," this corresponds to an equivalent change in level in the SFP of about 25 ft, which translates to about a 7 hour evolution duration at the capacity two SFP demineralizers in parallel (265 gpm/each).

Please revise and update the US-APWR DCD subsection 9.1.4.2.2.2 and subsection 12.3.1.3, to describe the design features provided to prevent overflowing the SFP while transferring the water from the transfer canal and refueling cavity areas to the RWSAT, or provide the specific alternative approaches used and the associated justification.

12.03-67

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) and the Primary Makeup Water Tank (PMWT), provided to minimize contamination of the facility and the environment, consistent with the guidance in RG 4.21 and the requirements of 10 CFR 20.1406. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012 stated in the proposed changes to DCD Subsection 9.1.4.2.2.2 "Reactor Refueling Operations," "Phase IV - Reactor Assembly," that most of the refueling cavity water is transferred to the Refueling Water Storage Pit (RWSP) by the CS/RHR pump and that the water in the transfer canal is transferred to the Spent Fuel Pit (SFP) by the transfer canal pump and then the water in the SFP is transferred to the RWSAT by the SFP pump via SFP demineralizer and the SFP filter. US-APWR DCD Revision 3 Figure 6.2.2-7 "Required Water Volumes vs. Pit Capacities," shows that 29,410 ft3 (~217,000 gallons) of water is transferred to the RWSAT from the refueling canal following an outage. The applicant's response to RAI 532-4019 Question 12.02-29 contains Figure A-2 "Detail of Cross Sections of the Tank House," depicting an illustration for the RWSAT which shows an overflow line from the tank going into a funnel located outside of the tank house building. The applicant has not committed to adding Figure A-2 to the DCD. However, neither the illustration on Figure A-2, US-APWR DCD Revision 3 Chapter 6 "Engineered Safety Features," nor US-APWR DCD Revision 3 Subsection 12.3.1.3 "Minimization of Contamination and Radioactive Waste Generation," have any information about the location of this funnel and the provision provided at the funnel for minimizing contamination of the facility or the environment. Staff experience at operating plants has been that when the tank is overflowed, water may spill out of this funnel.

Please revise and update the US-APWR DCD Chapter 6 and Subsection 12.3.1.3, to describe the location of the RWSAT overflow line and funnel and the design features provided to prevent minimize contamination of the facility and the environment from an overflow of the RWSAT, or provide the specific alternative approaches used and the associated justification.

12.03-68

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) and the Primary Makeup Water Tank (PMWT), provided to minimize contamination of the facility and the environment, consistent with the guidance in RG 4.21 and the requirements of 10 CFR 20.1406. The applicant's response to RAI 532-4019 Question 12.02-29 dated July 10 2012 stated in the proposed changes to DCD Subsection 11.2.2.1.2.3 "Maintenance/Refueling Operations,":

"During refueling, the containment vessel reactor coolant drain pumps are used to drain water from the reactor coolant loops to the holdup tank and the emergency core cooling system accumulators (ACC) to the refueling water storage auxiliary tank (RWSAT) while the drain water from the refueling cavity is directly sent to the refueling water storage pit (RWSP) by the CS/RHR pumps or gravity. In this case, typically both pumps are used to speed up the transfer of water from these areas. In this mode, the water is transferred directly to the RWSAT without entering the containment vessel drain tank (CVDT). During maintenance or outages, any remaining gas is purged from the system to the gaseous waste management system (GWMS) using nitrogen."

To the staff, this statement is confusing and the staff believes that the intent is as follows:: "During refueling, the containment vessel reactor coolant drain pumps are used to drain water from the reactor coolant loops to the holdup tank and the emergency core cooling system ACCs to the refueling water storage auxiliary tank (RWSAT). In this case, typically both CVDT pumps are used to speed up the transfer of water from these areas. In this mode, the water is transferred directly to the CVDT pumps without entering the CVDT. During maintenance or outages, any remaining gas is purged from the CVDT system to the GWMS using nitrogen. The water drained from the refueling cavity is sent directly to the refueling water storage pit (RWSP) by the CS/RHR pumps or gravity"

Please revise and update the proposed change to US-APWR DCD Subsection 11.2.2.1.2.3 to clarify the expected process for operating the CVDT pumps , or provide the specific alternative approaches used and the associated justification.

12.03-69

Title 10 of the Code of Federal Regulations (10 CFR), Part 20, "Standards for Protection Against Radiation," Section1101(b) "Radiation protection programs" requires that Occupational Radiation Exposures (ORE) be maintained as low as is reasonably achievable (ALARA) as defined in 10 CFR 20.1003, "Definitions", that is, making every reasonable effort to maintain exposure as low as possible. The guidance contained in Regulatory Guide (RG) 8.8 "Information Relevant for Ensuring that Occupational Radiation Exposures at Nuclear Power Stations is Reasonably Achievable," and RG 1.206 "Combined License Applications for Nuclear Power Plants" Section C.I.12.3.1 "Facility Design Features," state that the design should minimize ORE through the use of maintenance requirements and chemistry controls. Response to US-APWR RAI 980-6954 Revision 0 Question 12.03-49 dated January 1, 2013 states that most resin fines are removed by circulating the holdup tank water through the Boric Acid (B.A.) evaporator feed demineralizer and the Boric Acid (BA) evaporator feed demineralizer filter and the holdup tank. The B.A evaporator feed demineralizer filter has a 0.8 micron mesh size to remove remaining fines following each back washing to the holdup tank in the above operation. This operation removes broken resin fine sediments prior to the next backwashing into the holdup tank. Removing broken resin fines minimizes localized radiation levels around the tanks, B.A evaporator feed pumps and the associated flow control valves, reduces pump maintenance frequency, and minimizes resultant ORE.
However, the applicant's response to the question did not describe the design features of the Chemical and Volume Control System (CVCS) Hold Up Tanks (HUT) would prevent the development of a hot spot due to the accumulation of resin fines and crud in the bottom of the tanks. Regulatory Guide (RG) 8.8 Section C.2.h, states that systems containing resin present special hazards because of the concentrated nature of the radioactive material, and provides guidance for design features that may reduce the accumulation of radioactive material.

Please revise and update US-APWR DCD Section 12.3 "Radiation Protection Design Features" to describe the design features provided to prevent the increase in ORE due to the accumulation of resin fines in the CVCS Holdup Tanks from the backwashing of CVCS demineralizers, or describe the specific alternate approaches and the associated justification.


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