**REQUEST FOR ADDITIONAL INFORMATION 578-4483 REVISION 2**

4/27/2010

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 12.03-12.04 - Radiation Protection Design Features
Application Section: 12.3

QUESTIONS for Health Physics Branch (CHPB)

12.03-12.04-37

20.1406, ISG-006, RG-4.21

US-APWR DCD RAI 91-1496, Question 12.03-12.04-2 asked the applicant to address compliance with 10 CFR 20.1406(b), which requires the application to describe how facility design and operation will minimize contamination of the facility and environment.

The applicant noted in their response that Design Control Document (DCD) Revision 0 was submitted to NRC, prior to the issuance of RG 4.21, so the design features to address the RG 4.21 specific objectives of minimization of contamination and radioactive waste generation during the design life of the plant and its subsequent decommissioning, were either expressly described in the various DCD sections on plant systems, or deferred for further design development with vendor specifics.

As noted in Interim Staff Guidance DC/COL-ISG-06 “Evaluation and Acceptance Criteria for 10 CFR 20.1406 to Support Design Certification and Combined License Applications” (ISG-6), alternative methods to RG 4.21 may be acceptable to meet the requirements of 10 CFR 20.1406, provided the methods are documented fully in the DC or the COL applications, and accepted by the staff. In Question 12.03-12.04-2 the applicant was asked to describe the DCD design features provided to minimize contamination and to provide COL Information items in the applicable sections of the DCD addressing the objectives which are more operational or procedural in nature for the specific systems. However, since FSAR Tier 2 Revision 2 Chapters 3, 5, 6 and 10 do not mention 20.1406, and the only reference to 10 CFR 20.1406 in Chapter 9 is to the Spent Fuel Pool leakage detection system, it is not clear to the staff that the applicant has fully described the design provisions and program element requirements provided for compliance with 10 CFR 20.1406.

In Question 12.03-12.04-2, the applicant was asked to provide the general description of design features and program elements provided to comply with 20.1406(b), in Section 12.3 of the DCD along with a pointer directing the reader to the section of the DCD which specifically addresses the system. This information would facilitate NRC Staff understanding of how the applicant complied with 20.1406. However, while the response to question 12.03-12.04-2 provided a summary of how some specific objectives are met on a system basis, it did not include this information in FSAR.

Supplemental Question:

Please revised and update the US-APWR FSAR Tier 2 Revision 2, to fully describe how facility design will minimize, to the extent practicable, contamination of the facility and the environment compliant with the requirements of 10 CFR 20.1406.

12.03-12.04-38

20.1406, ISG-006, RG-4.21, SRP 12.03-12.04

RAI-91-1496 Question 12.03-12.04-2 Supplemental Question
In the original RAI the applicant was asked to describe specific examples of the design and operational considerations which demonstrate compliance with 10CFR20.1406. The applicant was asked to identify and add these considerations to the appropriate DCD sections in the USAPWR DCD and provide the basis for these considerations.

The staff had requested that the applicant include in the response how the design and operational objectives, accomplished the following objectives:

- Minimize leaks and spills and provide containment in areas where such events may occur,
- Provide for leak detection capability to provide prompt detection of leakage for any structure, system, or component which has the potential for leakage,
- Use leak detection instrumentation capable of detecting minor leaks in areas where it is difficult or impossible to conduct regular inspections (such as for spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of contamination from undetected leaks.

US-APWR FSAR Tier 2 Revision 2, Table 11.1-9 “Realistic Source Terms” states that a typical activity of tritium in the secondary side water and steam is 0.001µCi/g. In addition to the tritium activity, the stated activity of the Steam Generator blowdown and main steam system (MSS) exceeds 3 E-6 µCi/g and 1.5E-8 µCi/g, respectively, even when iodines and noble gases are excluded. Contrary to the information provided in FSAR Table 11.1-9, the applicant noted in their response that the Main Condenser is not expected to be a significant source of contamination within PWRs in general and the US APWR in particular.

The applicant was asked to describe design features for any other plant systems which may generate radioactive waste or could result in the contamination of non-radioactive systems. Based on the realistic source term information provided by the applicant, the Condensate and Feedwater System, Main Steam Supply System (MSS), Steam Generator Blowdown System (SGBDS), Auxiliary Steam Supply System (ASSS) and portions of the Main Condensers are examples of systems that are expected to contain low but detectable concentrations of radioactive material.

The information provided in the applicant’s RAI-91-1496 Question 12.03-12.04-2 response, does not address environmental contamination at the current generation PWR plants due to undetected leakage and subsequent release of tritium or other isotopes as a result of corrosion of buried piping from these types of systems. For example:

1. The applicant's response did not fully address the Condensate Storage and Transfer System, specifically the underground condensate transfer line from the hotwell to the condensate storage tank (CST), depicted on USAPWR FSAR Revision 2 Tier 2 Figure 12.3-1 as located in the Transformer Yard. As described in the USAPWR DCD Tier 2, Revision 2, section 10.4.1.2.1 "System Operation" states that during normal power operation, the hotwell level controller provides automatic makeup or rejection of condensate to maintain a normal level in the condenser hotwells. On low level, the makeup control valves open and admit condensate to the hotwell from the condensate storage tank. On high-water level, the condensate reject control valves open to divert water from the condensate pump discharge to the condensate storage tank.

2. The applicant's response did not fully address the ASSS, especially, any buried condensate piping. As noted in DCD section 10.4.11 "Auxiliary Steam Supply System", the ASSS is supplied by MSS during operation of the main steam system, or by the auxiliary boiler when main steam is not available. Condensed water from these components is collected in the auxiliary steam drain tank and then is transferred to the condenser during normal operation or to the auxiliary boiler when the main steam is not available. The Condensate Storage Facility supplies make up feed water to the auxiliary boiler. The auxiliary steam system supplies the following components:
   - Boric acid evaporator
   - Boric Acid Batching Tank
   - Non safety-related HVAC equipment
   - Steam for the condensate system deaerator for condensate heating during start up
   - Turbine gland seal
   - Deaerator heating
   - Pre-operational cleanup of the condensate and feedwater system.
   - Steam for maintaining pressure in the condensate system deaerator after a turbine trip.

3. The applicant's response did not fully address the Steam Generator Blowdown System, especially, any buried piping, including the resin transfer lines, and blowdown water discharge line connections to off site disposal systems. The Steam Generator Blowdown System has the following attributes noted in the DCD:

   10.4.8.2.2 "System Operation"
   In the case of primary to secondary Steam Generator (SG) tube leakage within the allowable tube leak rate, as specified in the plant technical specifications, blowdown water continues to be purified with SG blowdown demineralizers to remove the radioactivity entering from leaking SG tube(s). When the SG tube leak exceeds the allowable limits, the SG blowdown lines are automatically isolated upstream of the SG blowdown demineralizers by the SG blowdown return water radiation monitor high signal.

US-APWR FSAR Tier 2 Revision 2, Chapter 12, identifies some US-APWR general design features that would minimize the contamination of the facility and environment and would minimize the generation of radioactive waste. However, this information does not address design features that are unique to system designs or their locations in the

plant warranting more technical details, such as the auxiliary steam and condensate systems. Current plant experience has demonstrated that normal PWR plant operation will likely result in detectable levels of tritium as well as other radionuclides in systems like the Main Steam, Condensate and Auxiliary Steam and Auxiliary Boilers systems.

Supplemental Question:

Please revise and update the US-APWR FSAR Tier 2 to describe the design features for leakage prevention and early leakage detection that will be implemented for the condensate, steam generator blowdown, auxiliary steam and similar systems. If design features for leakage prevention are not applied, please describe how the combined construction and operating license applicants will address these systems. Include the information in the DCD and provide a markup of the text and appropriate revised diagrams/maps in your response.

12.03-12.04-39

20.1406, ISG-006, RG-4.21, SRP 12.03-12.04

USAPWR RAI 91-1496, Question 12.03-12.04-2, 10CFR20.1406 Supplemental Question

US-APWR DCD RAI 91-1496 Question, 12.03-12.04-2 asked the applicant to address how they will comply with the requirements of 10 CFR 20.1406. The question specifically asked the applicants to address radioactivity in systems such as the Main Condenser and any other plant systems which may generate radioactive waste or could result in the contamination of non-radioactive systems.

US-APWR FSAR Tier 2, Revision 2, Section 11.1.1.3 “Tritium” notes that the activity of H-3 in the secondary side water and steam is entirely controlled by the loss of water from the reactor coolant system through primary-to-secondary leakage. Section 10.1.2 “Protective Features” paragraph “Radioactivity Protection” states that under normal operating conditions, there are no radioactive contaminants of operational concern present in the steam and power conversion system; however, it is possible for the system to become contaminated through steam generator tube leakage. Section 10.3.3 “Safety Evaluation” notes that radioactive contamination of the Main Steam System (MSS) can occur by a primary side to secondary side leak in the Steam Generator (SG). Under normal operating conditions, there are no significant amounts of radioactivity in the Main Steam System (MSS). The applicant noted in their response to RAI-91-1496, Question 12.03-12.04-2 that the Main Condenser is not expected to be a significant source of contamination within PWRs in general and the US-APWR in particular.

However, these statements are not consistent with DCD Tier 2, Revision 2 Section 11.1.1.3 which states that typical activity of tritium in the secondary side water and steam is 0.001µCi/g. As noted in Table 11.1-4 “Parameters Used to Calculate Secondary Coolant Activity” which is based on 150 gallons per day of primary to secondary leakage. Also, information from currently operating plants shows that in the absence of primary to secondary leakage, tritium activity is still present in secondary side water and steam at concentrations determined by the rate of hydrogen perfusion through the SG U-Tubes, the amount of secondary side reuse and the secondary side

make up rate. This information shows that 2,000 to 100,000 pico Curies/liter of tritium will be present in the secondary side steam/condensate fluid. As the US-APWR design employs full reuse of SG blowdown water and anticipated secondary side make up rates are expected to be low, the secondary side tritium concentration is likely to be higher than in many of the current generation of PWR plants. Experience from currently operating plants, shows that leakage from these types of systems will represent an operational concern, for plants subject to the requirements of 10 CFR 20.1406.

Please revise and update US-APWR FSAR Tier 2, Revision 2 Chapter 10 and Section 11.1.1.3 to incorporate a description of the expected radioactivity in secondary plant fluid systems in the absence of identified primary to secondary leakage consistent with the source term provide in Section 11.1.1.3 and currently operating plant data.