REQUEST FOR ADDITIONAL INFORMATION 316-2296 REVISION 0

4/2/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 04.06 - Functional Design of Control Rod Drive System
Application Section: 4.6

QUESTIONS for Reactor System, Nuclear Performance and Code Review (SRSB)

04.06-1

RAI 4.6-1

GDC 4 requires that the CRDS should remain functional and provide reactor shutdown capabilities under adverse environmental conditions. In FSAR Section 4.6, the applicant states that failure in the CRDM cooling system will, in the worst case, result in an individual control rod trip or a full reactor trip. However, the staff was unable to find a discussion or reference that included a consideration of other environmental conditions, such as humidity, vibration, or possible pipe fracture releasing fluid onto the CRDMs that could affect the CRDS functional capabilities to provide a safe reactor shutdown.

Provide a discussion or reference(s) that identifies the environmental conditions that were evaluated to demonstrate the CRDS capabilities to operate and perform its design function in the reactor vessel cavity under adverse environmental conditions such that the requirements in GDC 4 are satisfied. Specifically, address the seismic qualification or failure of non-safety related equipment in vicinity of the CDRS (e.g., failure of an incore instrumentation line failure on CRDS), a description or reference to the equipment qualification program and how it relates to CDRS safety related performance during AOOs and PAs.

04.06-2

RAI 4.6-2

The instrumentation and controls for the non-safety-related reactor control is described in DCD Section 7.7 with Subsections 7.7.1.3 and 7.7.1.4 referring to the digital and analog control rod position indication systems respectively. In addition, a supplemental discussion of the two independent systems is presented in Chapter 16, Technical Specification (TS) BASES Section B 3.1.7, “Rod Position Indication.” The BASES discussion of the two methods of position indication is described in detail that clearly illustrates their diverse and independent system design to measure axially the RCCA position. In the TS, digital measurement is identified as Bank Demand Position Indication System and the analog measurement is referred to as the Rod Position Indication System. However, the term, “bank demand position indication system”, is not indentified in Subsection 7.7.1.3 but is described in terms of “motion demand signals”. Also, in Figure 7.1-1, it is unclear as to whether the bank demand position indication system is part of the Rod Position Indication System diagram block or the CRDM Control System

block. For consistency with TS Section 3.1.7, provide clarification in Subsection 7.7.1.3 to include the term “bank demand position indication system” and its relationship to Figure 7.1-1. Also, provide justification for not including the term in the ACRONYMS AND ABBREVIATIONS listing.

04.06-3

RAI 4.6-3

As discussed in Section 9.4.6, “Containment Ventilation System”, the control rod drive mechanism (CRDM) cooling system is part of the containment ventilation system which is classified as a non-safety related and non-seismic Category I system. The CRDM cooling system maintains the temperature of the CRDMs below design operating temperature by satisfying the following design bases: (1) Removal of heat dissipated by the CRDMs, (2) Continuity and reliability of operation with 100% standby capacity for system fans, and (3) During a loss of offsite power (LOOP) condition, the CRDM cooling fans are served by the alternate AC power source. However, references were not provided in this section to document the specific analysis and qualification of the CRDM cooling system to satisfy the design bases. Provide the reference(s) that identifies the analysis which supports qualification of the CRDM cooling system compliance to the design bases.

04.06-4

RAI 4.6-4

In FSAR Subsection 4.6.2, the applicant states that the protection of the essential components of the CRDS from the effects of postulated moderate and high energy water line breaks and associated generated missiles is described in Subsection 3.5.1.2. Primary missile protection is provided by locating the credible missile sources behind concrete walls and floors, and/or locating the SSCs outside the zones of postulated missile strikes. However, the discussion was a general description of the protection features without directly addressing the specific features incorporated to protect the CRDS components. Provide a reference or detail discussion that addresses the specific features incorporated to protect the CRDS components including the analysis that confirms the protection features satisfy the requirements of GDC 4.

04.06-5

RAI 4.6-5

In FSAR Section 4.6, the applicant states that GDC 23 is satisfied without providing a discussion or reference of an evaluation performed to come to this conclusion. The applicant also states that in the worst case, failure of the CRDM cooling system will result in an individual control rod trip or a full reactor trip. The staff considers the failure of the CRDM cooling system as an adverse condition by which the CRDS fails in an acceptable condition that prevents damage to the fuel cladding and excessive reactivity changes during failure thereby satisfying GDC 23. However, the staff believes that the

one adverse condition identified by the applicant is insufficient to conclude that GDC 23 is met without providing an evaluation of the adverse conditions considered. Provide a discussion or reference of an evaluation performed to confirm that GDC 23 is satisfied.

04.06-6

RAI 4.6-6

CRDS testing is categorized in several phases: (1) Prototype component testing; (2) Production testing of components; (3) On-site preoperational testing; and (4) Periodic in-service testing. In Section 4.6.3, reference is made to the CRDS operability assurance programs, described in Section 3.9.4.4, which were formed to confirm the functional performance of the CRDMs both statically and dynamically. This section states that the structural integrity of the RCS pressure boundary is confirmed by stress analysis performed in accordance with ASME Code, Section III. However, the section did not provide a discussion or a reference to a report of the analysis that demonstrates compliance with the ASME Code. Provide a discussion or a reference of the analysis that supports compliance with the ASME Code.

04.06-7

RAI 4.6-7

Although the Technical Specifications' (TS) Section 3.1 provides requirements for surveillance and testing of reactivity control systems, it was excluded from Section 4.6 as part of the CRDS operability assurance programs. Provide the justification to exclude TS Section 3.1 with respect to the CRDS operability assurance programs.

04.06-8

RAI 4.6-8

In Section 4.6.5, the applicant restates the description given in FSAR Section 4.6.4 that only a limited number of postulated events assume the availability of two reactivity control systems to prevent or mitigate the accident such as the SLB and LOCA. The applicant did not discuss or provide a reference to demonstrate that the combined performance of the two reactivity control systems is in compliance with GDCs 27 and 28. Provide a discussion or a reference of the analysis that confirms the combined performance of the two reactivity control systems is in compliance with GDCs 27 and 28.

04.06-9

RAI 4.6-9

During the review of FSAR Section 4.6, the staff found an editorial error between the ACRONYMS AND ABBREVIATIONS sections of Tier 1 and Tier 2 in regard to the SIS definition. Tier 1 refers to SIS as safety injection pump; whereas, Tier 2 defines SIS as

safety injection system. It is generally acknowledged that the conventional abbreviation for safety injection system is SIS. For consistency, correct the editorial error.

04.06-10

RAI 4.6-10

During the review of initial startup tests in respect to FSAR Section 4.6, the staff identify that the prerequisite section of test 14.2.12.1.9, “Reactor Control, Rod Control, and Rod Position Indication Preoperational Test”, has an editorial error in the list where the last prerequisite is mislabeled and added onto prerequisite 4. For consistency, correct the editorial error.

04.06-11

RAI 4.6-11

During the review of the initial startup tests in respect to FSAR Section 4.6, the staff identify that the acceptance criterion section D of test 14.2.12.2.1.8, “Rod Position Indication Test”, refers to “the required indication and alarm functions, as described in Subsection 7.7.1.4”; however, FSAR Section 7.7.1.4 does not discuss the required indication and alarm functions. Identify the FSAR section that supports the acceptance criterion of section D. A discussion of the control rod position monitor alarm functions is presented in FSAR Subsection 7.7.1.1.4. If this is not a complete list, provide a complete list or reference where the alarms can be found.