REQUEST FOR ADDITIONAL INFORMATION 288-2274 REVISION 1

3/25/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 03.09.06 - Functional Design Qualification and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints
Application Section: 3.9.6

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

03.09.06-1

General Design Criterion 1 requires that structure, systems and components (SSCs) important to safety be designed to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency as necessary to assure a quality product in keeping with the required safety function.

ASME QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," provides measures and guidelines to ensure that pumps, valves, and dynamic restraints are functionally designed and qualified to perform their safety functions during accident conditions. The staff is addressing QME-1-2007 in a revision to Regulatory Guide 1.100. FSAR Tier 2, Section 3.9.6.1 does not provide a discussion of whether or not all or portions of this standard will be used to functionally qualify safety-related pumps, valves, and dynamic restraints for the US-APWR. FSAR Tier 2 Section 3.10.2 references ASME QME-1-2002 for seismic and dynamic qualification of mechanical equipment, and Section 3.10.2.2 states QME-1-2007 is also used as guidance for valves.

Considering the above, address the following:

1. FSAR Tier 2 Section 3.9.6.1 does not address ASME QME-1-2007. Will the design and qualification requirements with respect to safety-related pumps, valves, and dynamic restraints adhere to the requirements of this standard? If not all, will portions of this standard be applied to the US-APWR?

2. If this standard is not being utilized, provide the bases for what is being proposed in FSAR Tier 2 Sections 3.9.6.1 and 3.10. Provide descriptions and examples of the following:

a) What type of qualification testing will be performed for these components? Will they be qualified by analyses, testing, or some combination of analysis and testing?

b) Describe the proposed functional qualification program and the ASME QME-1-2007 requirements for pumps, valves, and dynamic restraints. Provide a discussion of the differences with QME-1-2007.

03.09.06-2

FSAR Section 3.9.6 refers to Reference 3.9-13 as the basis for developing the US-APWR IST Program for ASME Code, Section III, Class 1, 2 and 3 safety related pumps, valves, and dynamic restraints. This reference specifies the Code for Operation and Maintenance of Nuclear Power Plants, OM, ASME, 1995 Edition through 2003 Addenda. Also, the acceptance criteria section of FSAR Table 3.9-13 states that ASME OM Code 2004 is applied. The US-APWR Design Certification application should reference the latest edition and addenda of the ASME OM Code incorporated by reference in the NRC regulations. Verify which edition and addenda of the Code are to be used in the FSAR as the basis for the IST program.

03.09.06-3

In Section 3.9.6.1 of the FSAR, the reference to the ISI requirement for ASME code Section III class 1, 2 and 3 pumps, valves and dynamic restraints is not clear. Provide additional information and clarify the ISI reference.

03.09.06-4

Consistent with GDC 37, 40, 43, and 46 requirements for testing of safety-related systems, provide additional information on provisions for testing pumps and valves at design basis conditions (flow, pressure, temperature). A review of the US-APWR FSAR application could find no evidence the design incorporates the necessary features (flow paths, instrumentation) necessary to perform a full range of design basis testing. Provide additional information to confirm that safety related systems have been provided with the necessary provisions to conduct design basis testing.

03.09.06-5

Clarify the specification to use ISTC 4.2 for motor-operated valve (MOV) testing. MOV testing is addressed in 50.55a(b) and is further discussed in GL 89-10, GL 96-05 and RIS 2000-03. It is not clear why ISTC 4.2 is being cited as providing the test requirements for MOVs absent the above listed NRC generic communications. Provide additional information and clarify the basis for the use of ISTC 4.2 requirement alone.

03.09.06-6

Discuss the relationship of the IST program to the Technical Specifications. 10 CFR 50.55a requires a commitment to include the IST program in the Technical Specifications. The discussion of the inservice test program in US-APWR Section 3.9.6.1 does not include a reference to the inclusion of the program within the Technical

Specifications. Provide a reference or additional information regarding the Technical Specification section where the IST program discussion resides.

03.09.06-7

US-APWR FSAR Tier 2, Section 3.9.6.2, "IST Program for Pumps," provides general information on the IST program for pumps to be used in the USAPWR reactor. Provide a full description of this operational program or specify that the COL applicant will need to supplement the USAPWR FSAR information to provide a full description of the IST program for pumps as part of the COL application.

03.09.06-8

The US-APWR FSAR Tier 2 discusses the functional design and qualification of safety-related equipment in several sections. The staff reviewed the methods described in the FSAR for establishing and measuring the reference values and IST values for the pump parameters. Figure 6.3-7 on page 6.3-70 of the FSAR does not include the valve arrangement to and from the spent fuel pool (SFP) demineralizer trains. To perform the required testing of Refueling Water Recirculation Pumps A&B, a test flow path and isolation capability of the flow path for each pump will need to be established. The required test flow path for each pump and the test flow path isolation cannot be discerned from Figure 6.3-7. Provide a flow diagram depicting the SFP demineralizer train valve arrangements or provide a written explanation of how each pump test flow path will be established to facilitate the required periodic OM Code pump testing.

03.09.06-9

The staff reviewed the descriptive information in the FSAR covering the IST program for those ASME Code Class 1, 2, and 3 system pumps whose function is required for safety. The US-APWR Section 5.5.8 (Inservice Testing Program) in the Technical Specifications of the FSAR states that the IST program provides controls for inservice testing of ASME Class 1, 2, and 3 components. Table 3.9-13 lists the Class 1, 2, and 3 pumps to be tested. Review of the flow diagrams and other systems information in the FSAR revealed other pumps with those class designations, but not included in the IST program. They are: four Class 2 Safety Injection (SI) Auxiliary Oil Pumps (if separate from the SI pumps), two Class 3 Boric Acid Transfer Pumps, and eight Class 3 Emergency Gas Turbine Fuel Oil Transfer Pumps. Provide additional information and rationale for why these pumps are not included in the IST program.

03.09.06-10

US-APWR FSAR Tier 2, Section 3.9.6.3, "IST Program for Valves," provides general information on the IST program for valves to be used in the USAPWR reactor. For example, this section states that the IST program will conform to the requirements of the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code), subsection ISTC, to the extent practical. The section states that guidance from NRC generic letters and industry and utility guidelines is considered in developing the IST program. The section states that the IST program will incorporate the use of non-

intrusive techniques to periodically assess degradation and performance of selected valves. The section notes that the operability test of safety-related power-operated valves may be either a static or dynamic test. Provide a full description of this operational program or specify that the COL applicant will need to supplement the USAPWR FSAR information to provide a full description of the IST program for valves as part of the COL application.

03.09.06-11

If safety-related thermal relief valves are used in the US-APWR design, discuss the testing of thermal relief valves as part of the IST program. The application does not make reference to the inclusion of thermal relief valves in the IST program. It is stated pressure relief valves used for protecting systems or portions of systems that perform a function in shutting down the reactor to a safe shutdown condition, in maintaining a safe-shutdown condition or in mitigating the consequences of an accident are subject to IST. Concern exists that any thermal relief valves may be excluded from the IST program. The OM Code Appendix I and SRP 3.9.6 Section II Acceptance Criteria 3.C.vi discuss the requirement to include safety-related thermal relief valves in the IST program. Provide clarification regarding use of thermal relief valves and whether IST requirements are applied.

03.09.06-12

The US-APWR FSAR Table 3.9-14 lists the valves proposed for inclusion in the inservice test (IST) program. The list identifies the valves by tag (identification) number and for each valve includes the following information;

- Description
- Type
- Safety related mission(s)
- Safety function(s)
- ASME IST category
- IST type and frequency
- Any notes identifying unique conditions applicable to the valve

This information is required by the ASME OM Code ISTA-1310 and ISTA-3110. Table 3.9-14 has been reviewed to ensure the information required by the Code is provided and that the information provided in the table is consistent with code requirements and consistent with other portions of the Design Certification documentation. This review has led to the following requests for additional information related to US-APWR Table 3.9-14:

(a) ISTC -3700 requires valves with position indication be regularly tested to verify the function of the position indication. Note 1 to Table 3.9-14 indicates the position indicators for the valves identified by note 1 will be tested by local inspection without valve exercise. Clarify how the code requirement to verify the function of the position indication system will be satisfied if the testing does not include valve exercising.

(b) Numerous valves in Table 3.9-14 indicate an operability test as part of the IST type. Operability testing is not defined in the table or the text. Operability can be interpreted in

many ways and without a clear definition of what is meant by operability it is difficult to determine if this testing is in accordance with code requirements. SRP 3.9.6 Section I.3.D specifies the methods to determine reference and inservice parameters be verified. The definition of what constitutes an operability test is needed to adequately evaluate the method. Define what is meant by an operability test.

(c) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iv.(3) requires the leakage criteria for valves constituting the reactor coolant pressure boundary pressure isolation valves (PIVs) be specified. Valves RCS-MOV-117A, 117B, 116A and 116B are classified as RCS pressure boundary valves yet they are categorized as code class B (no leakage criteria) valves. Provide additional information and clarify why leakage criteria is not established for these valves.

(d) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iv.(3) specifies leakage criteria for RCS PIVs be specified. Note 2 to Table 3.9-14 indicates valves RCS-MOV-119, 118, 002A, 002B, 003A and 003B are maintained closed to preserve the RCS pressure boundary yet no leakage criteria exists for the valves. Provide additional information and clarify why no leakage criteria is specified for these valves.

(e) Section ISTC-3520 of the ASME OM Code requires quarterly exercising of valves within the IST program. Alternate exercise frequencies are acceptable, if justified. It is indicated the following valves cannot be exercised quarterly as their exercising will interrupt necessary utilities leading to undesirable operational consequences. The valves in question are: RCS-AOV-132, 138, 147, and 148. From a review of the service provided by these valves, it is not clear that exercising the valves with the unit on line would have undesirable consequences or that a time could not be found when exercising would not have undesirable consequences. Provide additional information and clarify why quarterly testing of the valves cannot be performed.

(f) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.A indicates that a list of valves should be provided in the IST program, which includes the types of valves. Numerous valves, including CVS-LCV-451, 452, 121B, 121C, 121D, 121E, 121F and 121G, have " remote " listed as the type of valve. Remote is more applicable to the method of operation or control of the valve than the type of valve. Clarify how the designation of remote identifies the valve and actuator type, and provide additional information for the valves listed.

(g) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.v.(2) specifies the leakage criteria for containment isolation valves be established. The following valves are identified as containment isolation valves, yet no leakage criterion has been provided: SIS-MOV-001A, 001B, 001C, 001D, 009A, 009B, 009C, 009D, SIS-VLV-010A, 010B, 010C, 010D. Provide the leakage criteria or explain why no leakage criteria are appropriate.

(h) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iv.(3) requires that RCPB PIVs be identified. Valve SIS-VLV-012A is identified as a pressure isolation valve but is not identified as a RCPB PIV. Provide additional information and explain why the valve should not be classified as a RCPB PIV.

(i) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iv.(3) specifies that allowable leak rates be provided for RCPB PIV. The following valves are identified as

being RCPB PIV valves, but no allowable leak rate has been identified: SIS-MOV-014A, 014B, 014C, 014D. Provide the allowable leak rate or provide a justification why not listing an allowable leak rate is appropriate.

(j) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iv.(3) specifies RCPB PIVs be identified with leakage rates provided. The following valves are identified as RCS pressure boundary which are normally closed to maintain the RCPB: SIS-MOV-031B, 031D, 032B and 032D. No allowable leak rate is specified for the valves. Provide the allowable leak rate or provide a justification why one is not needed for these valves.

(k) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iii discusses the testing of check valves with the recommendation that non-intrusive means be used. Table 3.9-14 indicates valves SIS-VLV-102A, 103A, 102B, 103B, 102C, 103C, 102D and 103D will be tested by alternate (disassembly and inspect) means. Experience has demonstrated valves in this service (accumulator outlet check valves) can be tested using non-intrusive means. Provide additional information and clarify why non-intrusive means of testing cannot be applied to these check valves.

(l) Valves RHS-MOV-002A, 002B, 002C, and 002D in Table 3.9-14 are classified as RCS pressure boundary containment isolation category A valves. It is then stated these valves are not containment isolation leak tested as they are water sealed, in a closed system, and closed when in modes above hot shutdown. The ASME OM Code ISTC-3620 and 3630 discuss leakage requirements including those for containment isolation valves. Provide clarification regarding whether there are no design-basis scenarios where the water seals could be lost such that pressure isolation valve water testing is the only necessary leakage testing for these valves.

(m) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.iv.(3) states RCPB PIVs should be identified with allowable leak rates established. Valves RHS-MOV-026A, 026B, 026C and 026D are identified as RCPB PIVs, but no allowable leak rate has been specified. Justify why no allowable leak rates have been established for these valves or provide the allowable leak rates.

(n) Valves EFS-MOV-019A, 019B, 019C, and 019D in Table 3.9-14 are identified as containment isolation valves with seat leakage requirements. The ASME Code ISTC-1300 requires valves with established leakage values are classified as category A valves. The ASME OM Code ISTC-3610 further establishes the leak test requirements of category A valves. These valves are categorized as category B valves in the table. Provide additional information and justify why the valves have been categorized as category B when it has been stated seat leakage requirements apply.

(o) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.v.(2) specifies containment isolation valves and associated seat leakage requirements be identified. Valves NFS-VLV-512A, 512B, 512C, and 512D are identified as containment isolation valves, but are categorized as category B valves. Provide additional information and justify why these containment isolation valves are categorized as category B valves.

(p) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.A specifies valve type be identified. It is not clear from Table 3.9-14 what the valve type is for the following valves: NFS-VLV-512A, 512B, 512C, and 512D. As test requirements are dependent

upon valve type, it is necessary to know the valve type when reviewing test requirements. Provide additional information on categorization of the listed valves.

(q) The ASME OM Code ISTA-1500 (f),(g), and (h) require the performance of tests and examinations, recording of required tests and examination results that provide a basis for evaluation and facilitate comparison with the results of subsequent tests or examinations and the evaluation of tests and examination results. Note 11 to Table 3.9-14 states full stroke exercising is not possible with the unit at power, so partial stroke testing will be performed quarterly with full stroke testing at cold shutdown. It is further stated that to avoid potential valve damage, full stroke testing will be done using slow closure operation. This note is applied to valves NFS-VLV-512A, 512B, 512C and 512D. Provide additional information and justify how the proposed testing (partial stroke quarterly, slow full stroke testing at cold shutdown) demonstrates acceptable valve performance and how meaningful performance trends can be established.

(r) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.A specifies that for valves to be included in the IST program, the type of valve be identified. The valve type for NMS-HCV-3625, 3635, 3645 is not readily apparent. To adequately address the specified IST tests, the valve and actuator type must be known. Provide additional information on categorization of the listed valves.

(s) Valves CSS-MOV-004A, 004B, 004C and 004D are identified as containment isolation valves, but are shown as category B valves (no leakage requirement). SRP 3.9.6 section II Acceptance Criterion 3.C.v.(2) specifies leakage requirements be provided for containment isolation valves. Provide additional information and justify why these valves do not have established leakage requirements.

(t) Alternate exercise methods (disassembly and inspect) are specified for valves CSS-VLV-005A, 005B, 005C and 005D. SRP 3.9.6 Section II Acceptance Criterion 3.C.(iii) specifies the use of non-intrusive means of verifying check valve performance. Experience has shown valves in service similar to those identified have been successfully tested (using air as test medium) by the application of non-intrusive means. Provide additional information and justify why non intrusive means cannot be used for these valves.

(u) ASME OM Code ISTA-3110 requires that the components to be included in the IST program be identified. For valves EWS-VLV-602A, 602B, 602C and 602D, the function is not identified. The tests appropriate for the valve can depend upon its function, and thus must be identified. Provide additional information and identify the function of these valves.

(v) ASME OM Code ISTC-3510 requires active category A and C check valves be exercised quarterly unless full stroking during operation is not possible. The following valves are sampling system isolation valves which, due to a reluctance to interrupt the process, are scheduled to be tested on a cold shutdown frequency. Normally, sampling systems are not in continuous service, and even for those which are commonly in service, a momentary interruption in the process is not significant. Common practice is to exercise sampling valves quarterly. Provide additional information and justify why the following valves cannot be exercised quarterly:

LMS-AOV-060, 056, 055, 053, 052

LMS-LCV-1000B, 1000A
LMS-AOV-105, 104
PSS-AOV-003
PSS-MOV-006, 013, 023, 031A, 031B, 052A, 052B
PSS-AOV-062B, 062C, 062D, 063, 071
PSS-VLV-072
SGS-AOV-031A, 031B, 031C, 031D.

(w) ASME OM Code ISTC 3522 specifies the exercise requirements for check valves. If exercising at power is not possible, then cold shutdown or refueling interval testing is specified. Valve DWS-VLV-005 is identified as a containment isolation check valve, but no exercise requirement is identified. Provide additional information and identify and include the exercise requirements for this valve in Table 3.9-14.

(x) ASME OM Code ISTC-3510 and ISTC-3521 establish the requirements for exercising of valves in the IST program. Quarterly testing is to be performed unless it is not practical to do so. In that case, cold shutdown exercising is required or refueling exercising if cold shutdown testing is not practical. The following valves control essential chilled water necessary for environmental control to various safety related rooms/areas. The affected valves are VWS-TCV-2845, 2855, 2865, 2875, 2784, 2794,2804, 2814, 2574, 2584, 2594, 2604, 2671, 2676, 2681, 2686, 2721A, 2721B, 2721C, 2721D, 2726A, 2726B, 2726C, 2726D, 2731A, 2731B, 2736A, 2736B, 2741A, 2741B,2746A, 2746B,2331, 2336, 2341, 2346. These valves are specified to be exercised on a cold shutdown frequency based upon a reluctance to interrupt the process flow and potentially impact room environmental conditions. The chilled water is frequently not in continuous service, and further it is not clear how a momentary interruption of chilled water flow would have a significant impact on a room's environment. Provide additional information on the impact of a short duration interruption in essential chilled water flow, and explain how such an interruption would be of such consequence to justify a cold shutdown test interval.

(y) ASME OM Code ISTA-1500(g), ISTC-3510, ISTC-3521 establish the requirements for exercising of valves. ISTA-1500(g) establishes the requirement to record the results of tests and examinations that provide a basis for evaluation and facilitate comparison with results of subsequent tests or examinations while ISTC-3510 and ISTC-3521 establish the requirements for exercising frequency. Note 11 to Table 3.9-14 states for the identified valves, partial stroke tests will be performed quarterly with the unit on line and full stroke testing in the slow closure mode will be conducted at cold shutdowns. A slow stroke is specified to preclude potential damage to components. Provide additional information and justify how the combination of on line partial stroking and cold shutdown slow stroking permits evaluation of valve performance and comparison with past performance to evaluate performance trends.

(z) Standard Review Plan 3.9.6 Section II Acceptance Criterion 3.C.(iii),c(1)(a),(2),(3)(b) discusses the use of non-intrusive means in check valve testing. Note 12 to Table 3.9-14 indicates full stroke testing of the accumulator injection line check valves, containment spray containment isolation check valves, and the main steam line check valves cannot practically be performed, so these valves will be subject to alternate (disassembly and inspect) test methods. ASME OM Code ISTC-5221 recognizes alternate test methods, if other methods are impractical. By the use of non-intrusive means, the industry has been able to exercise and evaluate the performance of

containment spray containment isolation valves and accumulator injection check valves. Discuss why non-intrusive means cannot be employed and why alternate test methods are required.

(aa) Valves SIS-MOV-031A, 031B, 031C and 031D and SIS-VLV-032A, 032B, 032C and 032D are identified as reactor pressure boundary isolation valves. SRP 3.9.6 Section II Acceptance Criterion 3.C.(iv)(3) specifies reactor coolant pressure boundary valves are to be identified and allowable leakage rates provided. Contrary to this, these valves are categorized as category B valves. Provide additional information and justify why these valves are not categorized as category A valves with a leakage rate established.

03.09.06-13

US-APWR FSAR Tier 2, Section 3.9.6.3.1, “Inservice Testing Program for MOVs,” provides general information on the IST program for motor-operated valves (MOVs) to be used in the USAPWR reactor. Describe the IST program to be developed consistent with 10 CFR 50.55a that requires the IST provisions in the ASME OM Code to be supplemented with a program to ensure that MOVs continue to be capable of performing their design-basis safety functions. This section also needs to properly reference the guidance in NRC generic letters, and specify the consideration of temperature effects on MOV output. The section should indicate that MOV operating experience is incorporated such as by discussing the application of the Joint Owners Group Program on MOV Periodic Verification, and the consideration of periodic verification of MOV actuator output. Provide a full description of the MOV testing operational program or specify that the COL applicant will need to supplement the USAPWR FSAR information to provide a full description of the MOV testing program as part of the COL application.

03.09.06-14

FSAR Tier 2, Section 3.9.6.3.2, “Inservice Testing Program for POVs Other Than MOVs,” provides general information on the IST program from power-operated valves (POVs) other than MOVs to be used in the USAPWR reactor. The section does not describe the application of MOV lessons learned in developing the IST program for POVs, such as described in NRC Regulatory Issue Summary (RIS) 2000-03, “Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions.” Provide a full description of this operational program or specify that the COL applicant will need to supplement the USAPWR FSAR information to provide a full description of the IST program for POVs as part of the COL application.

03.09.06-15

The US-APWR FSAR Section 3.9.6.3.2 discusses the test parameters for solenoid valves. It states an acceptable stroke time and fail safe testing normally verify the operability of the valve’s solenoid. Other parameters such as voltage and current at their design basis extremes can influence solenoid valve behavior. Stroke time and a fail safe tests by themselves may not be sufficient to demonstrate operability without specifying the electrical parameters as indicated in RIS 2000-03 and SRP 3.9.6 Section II

Acceptance Criteria 3.C.ii(3). Provide additional information on solenoid valve testing for POVs.

03.09.06-16

The US-APWR FSAR Section 3.9.6.3.3 does not address check valves in series. Consistent with the OM Code ISTC-5223, for check valves in series, identify if the safety analysis requirements apply to the combination of the check valves or to individual valves. If a particular valve has a leakage requirement, that valve must be tested individually. No discussion was found regarding the approach for series check valves. Provide additional information and clarification on the testing requirements for check valves in series.

03.09.06-17

The US-APWR FSAR Section 3.9.6.3.3 does not address the allowed leakage rate for category A check valves. The OM Code ISTC-3610 and 10 CFR 52.47 specify requirements on the leakage rates for category A valves. Provide additional information and clarification on whether category A valves meet the leakage rate requirements.

03.09.06-18

SRP 3.9.6 Section II Acceptance Criterion 3.c.iii.(1)(d) indicates testing of check valves should include the effects of rapid pump starts and stops as expected for system operating conditions and should include any other reverse flow conditions that may occur during expected system operating conditions. These factors are not included in the discussion of check valve testing requirements in FSAR Section 3.9.6.3.3. Provide additional information on how the check valve testing program will address the above considerations.

03.09.06-19

The opening statements of FSAR 3.9.6.3.6 state that safety-related pressure relief devices, "….are specified in accordance with ASME OM Code for IST. The ISTs for these valves are identified ASME OM Code, Appendix I." These statements seem to imply that safety and relief valves for the US-APWR will be tested in accordance with the ASME OM Code Appendix I, but do not positively state that this is the case. The SRP 3.9.6 Section II Acceptance Criteria 3.vi.2 states that safety and relief valves tests should be conducted in accordance with Appendix I to the OM Code. Please provide confirmation that the safety and relief valves will be tested in accordance with the ASME OM Code Appendix I.

03.09.06-20

The US-APWR FSAR Section 3.9.6.3.2 addresses inservice testing of safety and relief valves. It is stated the test frequency for safety and relief valves is every 5 or 10 years. In addition to the 5 or 10 year requirement, it is required by Appendix I of the OM Code

that 20% of the valves in a group be tested each interval. The commitment to test 20% of the valves each interval is necessary to verify code compliance. Provide additional information and clarify these requirements for safety and relief valves.

03.09.06-21

10CFR50.55a(b)(3)(vi) requires exercising of manual valves in the IST program on a 2-year interval. In US-APWR FSAR Table 3.9-14, valve RCS-VLV-140 is identified as the vacuum venting line check valve bypass valve. The valve is a manual containment isolation valve subject to type A testing. No manual exercise of the valve is specified. Provide additional information and justify why a two-year exercise requirement has not been established for this valve.

03.09.06-22

In US-APWR FSAR Table 3.9-14, valves SIS-VLV-114 and DWS-VLV-004 are manual containment isolation valves. Seat leakage criteria have been established for these valves but, contrary to 10CFR50.55a(b)(3)(vi), no manual exercise test has been specified. Provide additional information and justify why these valves should not have a two-year manual exercise requirement.

03.09.06-23

FSAR Chapter 6 contains, among other subjects, a description of the containment isolation system. Included is Table 6.2.4-3 which describes the containment penetrations and the isolation means and a schematic of each penetration. The table and schematics have been reviewed against code and regulatory requirements and against other sections in the Design Certification for completeness, accuracy and consistency. The following areas were deemed to need additional information clarification or correction.

(a) SRP 3.9.6 Section II Acceptance Criterion 3.A requires the list of valves in the inservice test program (IST) be provided with the type of valve identified. Table 3.9-14 identifies the following valves as motor-operated valves: NCS-MOV-511, NCS-MOV-517. Table 6.2.4-3 identifies these valves as air-operated valves. Clarify the type of valve and correct the appropriate table.

(b) SRP 3.9.6 Section II Acceptance Criterion 3.A requires the type of valve is to be identified. Table 3.9-14 identifies valve PSS-AOV-071 as an air-operated valve while Table 6.2.4-3 identifies the valve as motor-operated valve PSS-MOV-071. Clarify the type of valve and correct the appropriate table.

(c) FSAR Table 6.2.4-3 identifies the containment isolation valves. Table 3.9-14 identifies the valves to be included in the IST program as required by SRP 3.9.6 Section II Acceptance Criterion 3.A. The following valves are identified as containment isolation valves and are included in Table 6.2.4-3. However, these valves are not included in Table 3.9-14. Explain the function of these valves and why they are not included in both tables. Clarify and correct the appropriate table.

FSS-VLV-003
FSS-VLV-001
FSS-VLV-006
FSS-MOV-004
CAS-VLV-103
CAS-VLV-101
RMS-VLV-005
RMS-MOV-003
RMS-MOV-001
RMS-MOV-002
IGS-AOV-002
IGS-AOV-001
LTS-VLV-002
LTS-VLV-001

(d) SRP 3.9.6 Section II Acceptance Criterion 3.C.v.(2) requires containment isolation valves be identified. Table 6.2.4-3 identifies the following as containment penetrations but provides no information on the isolation means. Provide additional information and clarify the means by which containment isolation is provided for penetrations P262R and P262L.

(e) ASME OM Code ISTC 3300 requires the operating time for containment isolation be provided. Contrary to this requirement, Table 6.2.4-3 does not provide the units for the stroke time of the containment isolation valves. Provide additional information and clarify the units for the isolation times.

(f) SRP 3.9.6 Section I 1.A states that pumps, valves, and dynamic restraints must be designed, manufactured, tested, and installed to perform their applicable safety function. Table 6.2.4-3 identifies the following valves as 36" air-operated butterfly valves. The identified stroke time for these valves is 5 (units presumed to be seconds). Industry experience indicates air-operated valves of this size take considerably longer than 5 seconds to operate. Provide additional information and clarify the operating time (5 seconds?) and discuss how this requirement will be satisfied.
VCS-AOV-305
VCS-AOV-306
VCS-AOV-304
VCS-AOV-307

(g) ASME OM Code ISTC 3300 requires the stroke time for containment isolation valves be provided. Table 6.2.4-3 identifies valves CSS-MOV-004A, 004B, 004C and 004D as motor-operated containment isolation valves, but the valve closure time is indicated as N.A. Provide additional information and justify why valve closure times are not applicable for these valves.

03.09.06-24

FSAR Section 9.2.1 discusses the essential service water system. Figure 9.2.1-1 portrays the schematic of the system and the valves in the system are discussed in Section 9.2.1.2.2.6. In neither the discussion nor the schematic are pressure relief devices discussed or shown. ASME OM Code ISTC-1100, ISTC-5240 and SRP 3.9.6

Section II Acceptance Criterion 3.C.vi specify relief valves are to be identified and tested. Provide additional information and discuss the design and operation of the essential service water system, the use of pressure relief devices, and the inclusion of pressure relief devices installed in the essential service water system in the inservice test program.

03.09.06-25

FSAR Section 9.2.2 discusses the component cooling water system. Section 9.2.2.2.2.1.5 states other relief valves are provided to relieve pressure. The location of the valves is not provided in the text nor shown on the schematic. ASME OM Code ISTA-1100, ISTC-5240 and SRP 3.9.6 Section II Acceptance Criterion 3.C.vi provide the requirements for the inservice testing of pressure relief valves. Provide additional information and discuss how the design of the component cooling system satisfies the requirements for inservice testing of pressure relief valves.

03.09.06-26

FSAR Section 9.2.2 discusses the component cooling water system. Section 9.2.2.1.1 states the component cooling water system has the ability to isolate the non-safety related portion of the system. From Figure 9.2.2.-1, it appears valves NCS-MOV-232A, 232B, 233A, 233B, 020A, 020B and NCS-VLV-033A provide the isolation. These valves are shown as category B valves. ASME OM Code ISTA-1300 requires valves be categorized and if leakage is significant to performance, the valve is to be categorized as a category A. Leakage from the safety-related portion to the non-safety related portion or leakage between the separate trains of the system can affect the ability of the system to perform its safety-related function. Provide additional information and discuss the isolation features of the component cooling water system and the significance of leakage between the safety-related trains and between the safety-related and non-safety related portions of the system and the basis for categorization of the valves.

03.09.06-27

FSAR Section 9.3.4 discusses and describes the chemical and volume control system (CVCS). Section 9.3.4.2.6.28 describes relief valves in the CVCS system. Few of these valves are shown on the system schematic Figure 9.3.4(1). ASME OM Code ISTC-1100 and ISTC-5240 requires the identification and testing of pressure relief valves. Identify the pressure relief valves installed in the CVCS system which are to be included in the inservice test program and the commitment to test these valves in accordance with Appendix I.

03.09.06-28

FSAR Sections 9.5.4 through 9.5.8 describe and discuss the gas turbine system, which is the source of emergency power, and associated support systems. Included in the discussion, is a description of the lubrication system, the starting air system, and the air intake and exhaust system. The discussion of the systems associated with the gas turbine system indicates the mechanical systems are designed to ASME Section III

requirements. Therefore, a number of components in systems associated with the gas turbine generator should be included in the inservice test program.

(a) Figure 9.5.4-1 shows the schematic for the gas turbine generator fuel oil transfer system. Though equipment identification numbers are not assigned, the fuel oil transfer pumps are shown to have discharge check valves. ASME OM Code ISTA-1100 requires components having certain safety functions be included in the inservice test program. The fuel oil transfer pump discharge check valves, if not closed, could compromise the ability of the fuel transfer system to supply fuel to the gas turbine generator. Provide additional information and discuss the inclusion and test requirements for the fuel oil transfer pump discharge check valves.

(b) FSAR Section 9.5.6 discusses the starting air system. Portions of the air start system are designed to ASME Section III requirements. Check valves are shown on the schematic for the starting air system and included in the system description to isolate the compressors from the air receivers so a broken line from a compressor will not affect the air receivers. ASME OM Code ISTA-1100, ISTC-3522 and ISTC-5221 discuss and establish the identification and inservice test requirements for check valves. Provide additional information and discuss how the components in the air starting system are included in the inservice test program. Include a discussion of leakage requirements. The discussion should include check valves and the pressure relief valves included in the air start system.

03.09.06-29

FSAR Figure 10.4.7-1 shows the schematic of the normal feedwater system. Valves NFS-VLV-511A, 511B, 511C and 511D isolate the normal feedwater system from the emergency feedwater system. These valves are not included in the inservice test program yet it appears they are the principle means by which normal feedwater and emergency feedwater are isolated, and diversion of emergency feedwater is possible if these valves do not function as expected. As such, it would appear these valves should be included in the inservice test program as specified by ASME OM Code ISTA-1100. Provide additional information and discuss the function of these valves and why they should not be included in the inservice test program.

03.09.06-30

FSAR Figure 10.4.9-1 is the schematic of the emergency feedwater system. This schematic shows valves EFS-VLV-018A, 018B, 018C, 018D as isolating the emergency feedwater system from the secondary side of the steam generators. ASME OM Code ISTA-1100 requires that valves which have certain specific functions be included in the inservice test program. The FSAR states that leakage through these valves can potentially result in steam binding of the emergency feedwater pumps. In light of this potential, provide additional information and discuss the safety function of these valves. Provide justification for why these valves should not be categorized at category A valves with leakage values established.

03.09.06-31

US-APWR FSAR Tier 1 Section 2.7.1.11 addresses the emergency feedwater system. ASME OM Code ISTA-1000 requires that pumps or valves that are required to perform a specific function in shutting down a reactor to the safe shutdown condition, in maintaining the safe shutdown condition or in mitigating the consequences of an accident are to be included in the inservice test (IST) program. Figure 2.7.1.11-1 depicts the emergency feedwater system. Leakage from the steam generators into the emergency feedwater system can potentially disable the emergency feedwater pumps due to voiding and steam binding. Isolation of the emergency feedwater system from the steam generators is therefore necessary. Figure 2.7.1.11-1 does not show an isolation means (check valves) between the steam generators and the emergency feedwater system. Discuss the need for and means of achieving this isolation and whether this information needs to be shown on Figure 2.7.1.11-1. Discuss whether these valves should be classified as category A valves per ISTC-1300.

03.09.06-32

US-APWR FSAR Tier 1 Section 2.7.1 addresses the emergency feedwater system. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A specify that the components and function (performance parameters) be identified and included in the IST program. Table 2.7.1 includes valves NMS-HCV-3615, 3625, 3635, and 3645 and provides the safety function as transfer closed. These valves are also included in Tier 2 Table 3.9-14, which provides the list of valves within the IST program, but this table shows the valves' safety function as maintain closed. Provide additional information and discuss the apparent inconsistency in the stated safety function.

03.09.06-33

US-APWR FSAR Tier 1 Section 2.7.3 addresses cooling water systems. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A specify that the components and function (performance parameters) be identified and included in the IST program. Table 2.7.3.1-2 includes valves EWS-MOV-503A, 503B, 503C and 503D and indicates the safety function of the valves is transfer open. These valves are listed in Tier 2 Table 3.9-14, which provides the list of valves within the IST program, with the safety function as transfer open and transfer close. Provide additional information and discuss the inconsistency in the stated safety function.

03.09.06-34

US-APWR FSAR Tier 1 Section 2.7.3 addresses cooling water systems. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A specify that the components and function (performance parameters) be identified and included in the IST program. Valves EWS-VLV-502A, 502B, 502C, 502D and EWS-VLV-602A, 602B, 602C and 602D are contained in Tier 2 Table 3.9-14, which provides the list of valves within the IST program, but are not included in Tier 1 Table 2.7.3.1-2. Provide additional information and discuss the apparent inconsistency in the stated safety function.

03.09.06-35

US-APWR FSAR Tier 1 Section 2.4.5 addresses the residual heat removal system. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A specify that the components and function (performance parameters) be identified and included in the IST program. Tier 1 Table 2.4.5-2 shows the safety function of valves RHS-VLV-022A, 022B, 022C and 022D as transfer open. Tier 2 Table 3.9-14, which provides the list of valves within the IST program, shows the safety function of these valves as transfer open and transfer closed. Provide additional information and discuss the reason why the content of the two tables is not consistent.

03.09.06-36

US-APWR FSAR Tier 1 Section 2.7.3.3 addresses the component cooling water (CCW) system. Figure 2.7.3.3-1 provides the schematic for the CCW system. It appears that the A and B trains of the CCW system may be connected by valves NCS-MOV-237A and B and NCS-MOV-232A and B. Tier 2 Table 3.9-14 shows these valves as category B with no leakage criteria specified. ASME OM Code ISTA-1100 requires the performance parameters of components in the IST program be identified. ASME OM Code ISTC-1300 states valves with specified leakage requirements are classified as category A valves. As leakage from one train of CCW to another may affect the ability of a CCW train to perform its safety function, provide additional information and discuss why these valves should not have leakage criteria specified and be classified as category A valves.

03.09.06-37

US-APWR FSAR Tier 1 Section 2.7.1.9 addresses the condensate and feedwater system. ASME OM Code ISTA-1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A requires the components in the IST program be identified, as well as the performance parameters. Tier 1 Figure 2.7.1.9-1 is the schematic of the normal feedwater system and shows valves NFS-VLV-512A, 512B, 512C and 512D as providing isolation between the normal feedwater system and the emergency feedwater system. Not shown are the normal feedwater check valves NFS-VLV-511A, 511B, 511C and 511D. Isolation of normal feedwater from emergency feedwater is necessary to avoid diversion of emergency feedwater from the steam generators through the normal feedwater system. Provide additional information and discuss how isolation between the two systems is provided, particularly if the normally open manual valves are the credited isolation means. If the check valves are credited, discuss whether they should be shown on the schematic. Discuss the IST requirements for the above valves.

03.09.06-38

US-APWR FSAR Tier 1 Section 2.7.3.5 addresses essential chilled water systems. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A specify that the components and function (performance parameters) be identified and included in the IST program. Tier 1 Table 2.7.3.5-2 provides equipment characteristics for components in the essential chilled water system. One of the characteristics provided is the safety function. Tier 2 Table 3.9-14 identifies valves in the IST program, and this

table also provides the safety function (described as safety mission). Inconsistencies exist in the safety mission/function as identified in Tier 1 Table 2.7.3.5-2 and Tier 2 Table 3.9-14 for the below listed valves. Discuss the safety mission/function for the valves listed below, and correct the appropriate table.

VWS-TCV-2845, 2855, 2865, 2875
Table 2.7.3.5-2; active safety function is transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2784, 2794, 2804, 2814
Table 2.7.3.5-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2574, 2584, 2594, 2604
Table 2.7.3.5-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2671, 2676, 2681, 2868
Table 2.7.5.3-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2721A, 2721B, 2721C, 2721D
Table 2.7.3.5-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2726A, 2726B, 2726C, 2726D
Table 2.7.3.5-2: safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2731A, 2731B, 2731C, 2731D
Table 2.7.3.5-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2741A, 2741B, 2741C, 2741D
Table 2.7.3.5-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

VWS-TCV-2331, 2336, 2341, 2346
Table 2.7.3.5-2; safety function transfer open
Table 3.9-14; transfer open, transfer close

03.09.06-39

US-APWR FSAR Tier 1 Section 2.7.6.3 addresses the spent fuel pool cooling and purification system. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A requires that components in the IST program and their performance parameters be identified. Tier 1 Table 2.7.6.3-2 identifies valves SFS-VLV-101A, 101B, 133A and 133B as ASME Section III Seismic Category 1 valves that isolate the safety-related spent fuel pool cooling system from the non-code purification system. This is a

safety-related function, and these valves should be in the IST program. Provide additional information and discuss the inclusion of these valves in the IST program.

03.09.06-40

US-APWR FSAR Tier 1 Section 2.7.6.8 addresses the equipment and floor drainage systems. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A requires that components and their performance parameters be included in the IST program. Section 2.7.6.8.1 describes the drainage and flood protection for rooms containing safety equipment. The section states that drain systems from engineered safety feature (ESF) rooms are designed to prevent flooding due to backflow by virtue of a difference in elevation of the ESF equipment rooms and the collective sump. Additionally, isolation valves are also provided on the ESF equipment room drainage piping in order to protect against flooding due to backflow. It is not clear if the elevation difference is sufficient to prevent flooding from backflow or if the installed valves are also credited for preventing backflow-induced flooding. Provide additional information and discuss the credited mean(s) of preventing backflow-induced flooding. If the installed valves in the ESF room drains are credited with backflow prevention, discuss the need to include these valves in the IST program.

03.09.06-41

US-APWR FSAR Tier 1 Section 2.7.6.7 addresses the process and post-accident sampling systems. ASME OM Code ISTA 1100 and SRP 3.9.6 Section II Acceptance Criteria 3.A requires that the components and their performance parameters be included in the IST program. Table 2.7.6.7-1 includes valve PSS-MOV-006, which is identified as a motor-operated valve. This valve is shown to fail closed. Motor-operated valves typically fail as-is. Provide additional information and clarify the failure mode/position for this valve.

03.09.06-42

US-APWR FSAR Tier 1 Section 2.4.6 addresses the chemical and volume control system (CVCS). ASME OM Code ISTA-1100 and SRP 3.9.6 Section II Acceptance Criterion 3.A requires that components and performance parameters be included in the IST program. Tier 1 Table 2.4.6-2 provides equipment characteristics of components within the CVCS system. Tier 2 Table 3.9-14 provides the list of valves within the IST program. For the valves listed below, inconsistencies in safety function/mission exist between Tier 1 Table 2.4.6-2 and Tier 2 Table 3.9-14. Provide additional information and clarify the safety function/mission of these valves and correct the appropriate table.

CVS-LCV-121D, 121E, 121F, 121G
Table 2.4.6-2; transfer open
Table 3.9-14; transfer open, transfer closed

CVS-VLV-156
Table 2.4.6-2: no active safety function indicated
Table 3.9-14; transfer closed

CVS-AOV-159
Table 2.4.6-2; shows incorrect fail position, active safety function shown as transfer open and transfer closed
Table 3.9-14; safety mission is transfer closed

CVS-VLV-160, 161
Table 2.4.6-2; no active safety function indicated
Table 3.9-14; transfer closed

CVS-VLV-179A, 179B, 179C, 179D
Table 2.4.6-2; no active safety function indicated
Table 3.9-14; transfer closed

CVS-VLV-181A, 181B, 181C, 181D
Table 2.4.6-2; no active safety function indicated
Table 3.9-14; transfer open, transfer closed

CVS-VLV-182A, 182B, 182C, 182D
Table 2.4.6-2; no active safety function indicated
Table 3.9-14; transfer open, transfer closed

03.09.06-43

USAPWR FSAR Tier 2, Section 3.9.3.4.2.9, “Snubber Examination and Testing,” and Section 3.9.6.4, “Inservice Testing Program for Dynamic Restraints,” provide general information on the inservice testing (IST) program for dynamic restraints to be used in the USAPWR reactor. Provide a full description of this operational program or specify that the COL applicant will need to supplement the USAPWR FSAR information to provide a full description of the IST program for dynamic restraints as part of the COL application.

03.09.06-44

US-APWR FSAR Section 3.9.6.1 in the middle of page 3.9-76 states: “The various provisions for testing pumps, valves, and dynamic restraints are incorporated into the design of the US-APWR. These provisions and requirements are discussed in the respective sections of this DCD where the specific system is described.” None of the specific systems which are supposed to contain the provisions and requirements for dynamic restraint testing are identified and listed in FSAR Section 3.9.6 or 3.9.6.4. A review of the systems for the Component Cooling Water, Essential Chilled Water, Non-Essential Chilled Water, Spent Fuel Pool Cooling, and Emergency Core Cooling Systems indicates that the provisions and requirements for inservice testing are not specifically addressed. Some of the systems just refer back to Section 3.9.6 with very limited or no information regarding the IST Program for Dynamic Restraints. SRP 3.9.6 Section II Acceptance Criterion 4.C indicates that the applicant should identify and tabulate all safety-related components that use snubbers in their support systems. The specific systems the FSAR applicant is referring to are not identified or tabulated. Provide additional information on the design provisions and requirements for dynamic

restraint inservice testing that apply to each of the specific safety-related systems or clarify that this will be included in an applicable COL item.

03.09.06-45

SRP 3.9.6 states in Subsection I, Areas for Review, “The review should include any other pumps and valves and dynamic restraints not categorized as ASME Code Class 1, 2,or 3 that are safety related”. The staff review of the US-APWR FSAR Section 3.9.6 or 3.9.6.4 could not locate where safety related dynamic restraints not categorized as ASME Code Class 1, 2, or 3 are addressed. Provide additional information and clarify whether or not the US-APWR design uses safety related dynamic restraints that are not categorized as ASME Code Class 1, 2, or 3.

03.09.06-46

US-APWR FSAR Subsection 3.9.6.4 states: “Snubber operability inspections and tests including scope and frequency requirements are specified and controlled in the Components Support Inspection and Testing Program Plan”. The “Components Support Inspection and Testing Program Plan” was not available in the US-APWR FSAR documentation. Provide the document titled “Components Support Inspection and Testing Program Plan” to allow for staff review or clarify that this is addressed as a COL item.

03.09.06-47

US-APWR Tier 2, Section 3.9.6.5, “Relief Requests and Alternative Authorizations to the OM Code,” states that experience was used in designing and locating pumps, valves, and dynamic restraints to permit access for performing preservice and IST required by ASME OM Code. The applicant states that relief from the testing requirements of the ASME OM Code is requested when full compliance with requirements of the ASME OM Code is not practical. In such cases, specific information will be provided that identifies the applicable Code requirements, justification for the relief request, and the testing method to be used as an alternative. The applicant notes that Tables 3.9-13 and 3.9-14 identify any relief requests for pumps and valves, respectively. The staff review did not find any relief requests in Table 3.9-13 or 3.9-14. US-APWR FSAR Tier 2, Section 3.9.6.1 states that relief requests from any of the applicable ASME OM Code test requirements will be documented in the IST Program Plan, including justification and proposed alternative tests or examinations that assess operational readiness of the impacted pumps, valves or dynamic restraints. The applicant should clarify whether any relief requests are included for the US-APWR IST program and provide the necessary information to justify any such relief.

03.09.06-48

US-APWR Tier 2, Table 1.8-2, “Combined License Information,” lists several COL information items related to IST programs for pumps, valves, and dynamic restraints to be used in the US-APWR reactor. Specify COL information items that require the COL

applicant to provide a full description of the IST operational program for pumps, valves, and dynamic restraints, and MOV testing operational program.