Jeff Ciocco

From: Jeff Ciocco
Sent: Monday, August 25, 2008 1:26 PM
To: us-apwr-rai@mhi.co.jp
Cc: James ODriscoll; Christopher Jackson; Ruth Reyes; Larry Burkhart
Subject: US-APWR Design Certification Application RAI 57-852
Attachments: US-APWR DC RAI 57 SPCV 852.pdf

MHI,

Attached please find the subject request for additional information (RAI). This RAI was sent to you in draft form. The schedule we established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. Please submit you RAI response to the NRC Document Control Desk.

Thanks,

Jeff Ciocco
Office: T-7F14
New Reactor Licensing
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2739
301.415.6391
jeff.ciocco@nrc.gov

REQUEST FOR ADDITIONAL INFORMATION NO. 57-852 REVISION 0

8/25/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 06.02.04 - Containment Isolation System

Application Section: 6.2.4

SPCV Branch

QUESTIONS

06.02.04-1

(6.2.4-1)
Provide justification for Systems with single valve isolation- Hot Leg CS/RHR line.

In section 6.2.4.3.2 in the DCD application, you have stated that table 6.2.4-2 lists GDC 55 and 56 systems with single valve isolation and provides justification for use of single valve protection. Additional justification is needed in order to demonstrate that the configurations meet the requirements of the ANSI N271-1976 "other defined basis" of GDC 55:

For the Hot leg CS/RHR Pump Suction Line valves (Figure 6.2.4-1 sheet 12), provide:
a discussion that the RHRS is shown to be more reliable with this configuration,
a discussion that a single active failure can be accommodated with only one valve in the line,
a discussion on how leak testing that portion of the RHRS outside of containment is performed, or how it can be shown that system integrity can be maintained during normal plant operations.

06.02.04-2

(6.2.4-2)
Provide justification for Systems with single valve isolation-SI pump suction line; provide discussion on leak housing.

In section 6.2.4.3.2 in the DCD application, you have stated that table 6.2.4-2 lists GDC 55 and 56 systems with single valve isolation and provides justification for use of single valve protection.
Additional justification is needed in order to demonstrate that the configurations meet the requirements of the ANSI N271-1976 "other defined basis" of GDC 56:
For the SI pump suction line valves (Figure 6.2.4-1 sheet 11) provide:
a discussion that the SIS is shown to be more reliable with this single valve configuration,

a discussion that a single active failure can be accommodated with only one valve in the line,
a discussion how leak testing that portion of the SIS outside of containment is performed, or how it can be shown that system integrity can be maintained during normal plant operations.
ANSI N271-1976, Section 3.6.4 defines the basis for lines consisting of a single valve and a closed system which are both located outside containment. Pursuant to this section, provide a discussion of the design of any protective or leak tight or controlled leakage housing that encloses the single valve and the piping between the containment and the valve.

06.02.04-3

(6.2.4-3)
Provide justification for systems with single valve isolation-CS/RHR pump suction line; provide discussion on leak housing.

In section 6.2.4.3.2 in the DCD application, you have stated that table 6.2.4-2 lists GDC 55 and 56 systems with single valve isolation and provides justification for use of single valve protection.
Additional information is needed in order to demonstrate that the configurations meet the requirements of the ANSI N271-1976 other defined basis of meeting the requirements of GDC 56:
For the CS/RHR pump suction line valves (Figure 6.2.4-1 sheet 18) provide:
a discussion that the CS/RHR system is shown to be more reliable with this single valve configuration,
a discussion that a single active failure can be accommodated with only one valve in the line,
a discussion how leak testing that portion of the RHRS outside of containment is performed, or how it can be shown that system integrity can be maintained during normal plant operations.
ANSI N271-1976, Section 3.6.4 defines the basis for lines consisting of a single valve and closed systems which are both located outside containment. Pursuant to this section, provide a discussion of the design of any protective or leak tight or controlled leakage housing that encloses the single valve and the piping between the containment and the valve.

06.02.04-4

(6.2.4-4)
Clarify design requirements that prevent debris from interfering with valve closure.

Pursuant to RG 1.206 section C.I.6.2.4.2 guidance, provide a discussion on the design requirements of the containment isolation barriers as they pertain to provision taken to ensure that closure of any containment isolation valves is not prevented by debris that could become entrained in escaping fluid.
Specifically discuss the following penetrations:
Penetration#152,153,156,157 (Safety injection Pump Suction line)

Penetration #151,154,155,158 (Containment Spray/Residual Heat Removal (CS/RHR)) pump suction line.

06.02.04-5

(6.2.4-5)
<u>Clarify placement of outermost CIV as close as possible to containment for GDC 55 and 56 systems</u>

In Section 6.2.4.3.3, you state that valves outside containment in systems designed in conformance with GDC 57 will be located as close to containment as practical. State in the DCD that the outside containment isolation valve shall be located as close to containment as practical for those systems designed in conformance with GDC 55 and 56 or designed in conformance with some other defined basis set forth in RG 1.141.

06.02.04-6

(6.2.4-6)
<u>Describe ITAAC for verification of containment isolation valve placement.</u>

How will completion of COL item 6.2(6), as written, ensure that the supplied as-built piping distances from the outer containment isolation valve to the containment will be such that the valves are located as close to containment as practical? (i.e. describe any inspections tests or acceptance criteria which will confirm that the as built piping distances will not exceed those listed in table 6.2.4-3)

06.02.04-7

(6.2.4-7)
<u>Provide Conditions requiring containment isolation</u>

Pursuant to 10 CFR 50.34(f)(2)(xiv), state the listing of all systems identified as essential and non essential, along with the basis for selection of each essential system, or confirm that essential systems are those listed as "yes" under the "ESF or Support System" column in DCD table 6.2.4-3.

For each nonessential system, include a description in the DCD that confirms that all designated nonessential systems are isolated automatically by the containment isolation signal.
Regulatory Guide 1.206, Section C.I.6.2.4.1 states that the applicant should discuss the design bases for the containment isolation system, including the design requirements for the governing conditions under which containment isolation becomes mandatory. The staff did not find in US-APWR DCD Tier 2 (Rev. 0) Section 6.2.4.1 sufficient detail to evaluate this design bases. Provide more information on the conditions under which containment isolation becomes mandatory.

06.02.04-8

(6.2.4-8)
Clarify design requirements for relief valves used as containment isolation barriers.

Per, ANSI N271-1976, section 4.74, when relief valves that discharge into containment are also used for containment isolation barriers, the discharge side of the valve shall be designed to withstand and be tested at the containment design pressure.
The four Containment Spray/Residual Heat Removal System (CS/RHR) Pump suction lines (6.2.4-1 Sheet 12) rely on relief valves for such purpose.
Pursuant to the guidance in Sections 3.6.6 and 4.74 of ANSI N271-1976, state in the DCD that the discharge side of the relief valves in the CS/RHR pump suction lines are designed to withstand and be tested at the containment design pressure.

06.02.04-9

(6.2.4-9)
Clarify if all power operated CIVs have position indication in the MCR, SBO considerations for indication and closure.

Pursuant to the guidance in section 4.2.3, provide a description in the DCD that states that all power operated isolation valves have position indication in the main control room. In addition, pursuant to RG 1.155 section C.3.2.7, indicate if provisions are provided, independent of the preferred and blacked out unit's onsite emergency ac power supplies, for valve position indication and closure for containment isolation valves that may be in the open position at the onset of a station blackout.
Address these valves in particular:
RWS-MOV-002 (Figure 6.2.4-1 Sheet 32) refueling water recirculation pump suction line
RWS-MOV-004 (Figure 6.2.4-1 Sheet 32) refueling water recirculation pump suction line.

06.02.04-10

(6.2.4-10)
Justify Failed-Open position of penetration #283 valves upon loss of power.

As described in Table 6.2.4.2-3 The two motor operated valves associated with penetration **#283** (CVCS seal water return line) fail as-is upon loss of power, however, their post accident position is closed. Pursuant to the requirement of GDC 55 as it relates to the criteria that, upon the loss of actuating power, the position of automatic isolation valves should take the position of greatest safety, explain how a failed- open position of the two MOVs in series, as shown in figure **6.2.4-1 sheet 8**, is the position of greatest safety upon loss of power.

06.02.04-11

(6.2.4-11)
Justify the failed open position of penetration #267L valves upon loss of power.

As described in Table 6.2.4.2-3, the two motor operated valves associated with penetration **#267L** fail as-is upon loss of power, however, their post accident position is closed. Pursuant to the requirement of GDC 55 as it relates to the criteria that, upon the loss of actuating power, the position of automatic isolation valves should take the position of greatest safety, explain how a failed- open position of the two MOVs in series, as shown in figure **6.2.4-1 sheet 27**, is the position of greatest safety upon loss of power.

06.02.04-12

(6.2.4-12)
<u>Justify the failed open position of penetration #269R valves upon loss of power.</u>

As described in Table 6.2.4.2-3, the two motor operated valves associated with penetration **#269R** fail as-is upon loss of power, however, their post accident position is closed. Pursuant to the requirement of GDC 55 as it relates to the criteria that, upon the loss of actuating power, the position of automatic isolation valves should takes the position of greatest safety, explain how a failed- open position of the two MOVs in series, as shown in figure **6.2.4-1 sheet 28**, is the position of greatest safety upon loss of power.

06.02.04-13

(6.2.4-13)
<u>Justify failed open position of penetration #161 valves upon loss of power.</u>

As described in Table 6.2.4.2-3, the two motor operated valves associated with penetration **#161** fail as-is upon loss of power, however, their post accident position is closed. Pursuant to the requirement of GDC 56 as it relates to the criteria that, upon the loss of actuating power, the position of automatic isolation valves should takes the position of greatest safety, explain how a failed- open position of the two MOVs in series, as shown in figure **6.2.4-1 sheet 32**, is the position of greatest safety upon loss of power.

06.02.04-14

(6.2.4-14)
<u>Justify failed open position of penetration #266 valves upon loss of power.</u>

As described in Table 6.2.4.2-3, the two motor operated valves associated with penetration **#266** fail as-is upon loss of power, however their post accident position is closed. Pursuant to the requirement of GDC 56 as it relates to the criteria that, upon the loss of actuating power, the position of automatic isolation valves should takes the position of greatest safety, explain how a failed- open position of the two MOVs in series, as shown in figure **6.2.4-1 sheet 44**, is the position of greatest safety upon loss of power.

06.02.04-15

(6.2.4-15)

Provide justification of containment setpoint pressure for phase A containment isolation.

10 CFR 50.34(f)(2)(xiv) requires reduction of the containment setpoint pressure that initiates containment isolation for nonessential penetrations to the minimum value compatible with normal operating conditions. Clarification on this requirement is provided in NUREG-0737 "Clarification of TMI Action Items", which states: "The pressure setpoint selected should be far enough above the maximum observed (or expected) pressure inside containment during normal operation so that inadvertent containment isolation does not occur during normal operation from instrument drift or fluctuations due to the accuracy of the pressure sensor. A margin of 1 psi above the maximum expected containment pressure should be adequate to account for instrument error. Any proposed values greater than 1 psi will require detailed justification. Applicants for an operating license and operating plant licensees that have operated less than one year should use pressure history data from similar plants that have operated more than one year, if possible, to arrive at a minimum containment setpoint pressure." Pursuant to the requirement of 10 CFR 50.34(f)(2)(xiv) explain (or indicate where in the DCD application it is explained) why the chosen setpoint of 21.5 psia for the High Containment Pressure actuation of Containment isolation phase A function is determined to be the minimum value compatible with normal operating conditions. Provide justification for this set point as described in NUREG-0737 "Clarification of TMI Action plan Requirements

06.02.04-16

(6.2.4-16)

Clarify basis of containment valve closure times.

In meeting GDC 54 requirements the performance capability of the isolation function should reflect the safety importance of isolation system lines. In section 6.2.4.2 of the DCD you specify the basis of containment valve closure times for valves 3.5 inches and larger.

As stated in paragraph 4.4.4 of ANSI N271-1976, closure times for valves 3.5 inches or smaller is generally less than 15 seconds.
Specify in section 6.2.4.2 of the DCD that containment isolation valves 3 inches and smaller will close within 15 seconds, or provide the basis for other closure times for these valves. Explain how the potential effects of water hammer and erosion were considered in the establishment of CIV closure times.

06.02.04-17

(6.2.4-17)

Clarify calculation of low volume purge CIV closure time and BTP 6-4 compliance.

Pursuant to BTP 6-4, describe (or indicate where in the DCD it is described) any analyses of radiological consequences that were used to establish the 8-inch low volume purge and vent system penetration line sizing and 5 second isolation valve closure time. Indicate how the proposed low volume purge system penetration line sizing and isolation valve closure time will be confirmed by site specific accident dose analyses in order to ensure that the radiological consequences of a LOCA, assuming the purge valves are open and subsequently close, will not exceed 10 CFR 100 guideline values.
In addition, indicate where the analysis to support compliance with BTP 6-4 acceptance criterion #5 A through D is located in the DCD.

06.02.04-18

(6.2.4-18)
Clarify administrative controls and leak testing provisions for flanged closures

Pursuant to GDC 54 as it relates to requirements that the design of piping systems penetrating containment with a capability to periodically test the operability of the isolation valves and associated apparatus, state in the DCD that the containment penetration barriers that consist of flanged closures are under administrative controls similar to manual valves and have provisions for containment leak testing in accordance with ANSI N271-1976, paragraph 5.3. Include a discussion of the Containment Leak Rate Testing System (LTS) penetration (Figure 6.2.4-1 sheet 47) and the oil supply and drain line for the RCP motor penetrations penetration (Figure 6.2.4-1 sheet 48) in your response.

06.02.04-19

(6.2.4-19)
Clarify administrative controls and leak testing provisions for personnel airlock.

Pursuant to RG 1.141 guidance (ANSI N271-1976, paragraph 4.10) state in the DCD that the personnel airlock will be under administrative controls similar to manual valves and have provisions for containment leak testing in accordance with ANSI N271-1976, paragraph 5.3. Provide descriptions of the accommodations for leakage testing that are provided for in the airlock design.

06.02.04-20

(6.2.4-20)
Clarify administrative controls and leak testing provisions for equipment hatch

Pursuant to RG 1.141 guidance (ANSI N271-1976, paragraph 4.10), state in the DCD that the equipment hatch will be under administrative controls similar to manual valves and have provisions for containment leak testing in accordance with ANSI N271-1976, paragraph 5.3. Provide descriptions of the accommodations for leakage testing that are provided for in the hatch design.

06.02.04-21

(6.2.4-21)
Clarify administrative controls and leak testing provisions for fuel transfer tube.

Pursuant to RG 1.141 guidance (ANSI N271-1976, paragraph 4.10), state in the DCD that the fuel transfer tube will be under administrative controls similar to manual valves and have provisions for containment leak testing in accordance with ANSI N271-1976, paragraph 5.3. Provide descriptions of the accommodations for leakage testing that are provided for in the fuel transfer tube design.

06.02.04-22

(6.2.4-22)
Clarify administrative controls and leak testing provisions for the 14 spare penetrations.

Pursuant to RG 1.141 guidance (ANSI N271-1976, paragraph 4.10), state in the DCD that the fourteen spare penetrations listed in DCD Table 6.2.4-3 will be under administrative controls similar to manual valves. This table notes that they will be Appendix J Type B leak tested. Describe the accommodations for leakage testing that are provided for in the spare penetrations design in accordance with ANSI N271-1976, paragraph 5.3.

06.02.04-23

(6.2.4-23)
Clarify if CCWS lines to/from the letdown HTEX meet GDC 57 criteria.

Section 6.2.4.3.3 of the DCD application lists those systems (or portions of systems) that meet the criteria of GDC 57. Explain why the Component Cooling Water (CCWS) inlet and outlet for the letdown heat exchanger is not included with those lines listed in paragraph 6.2.4.3.3.

06.02.04-24

(6.2.4-24)
Clarify nomenclature for the Main steam depressurization valves.

Clarify the proper valve designation of the main steam depressurization valves. Figure 6.2.4-1 lists these valves as NMS-MOV-507A,B,C,D, however Table3.2-2 lists thee valves as NMS-MOV-508A,B,C,D.

06.02.04-25

(6.2.4-25)
Clarify if portions of the MSS system meet GDC 4 criteria, inclusion of MSS valves as barriers.

The following is in reference to item #8 Main Steam System (MSS) in Table 3.2.2. Pursuant to GDC 4 with regard to the designation of structures systems and components important to safety which are designed to withstand the effects of and withstand the environmental conditions associated with postulated accidents, confirm if the main steam piping including the branch pipe from the steam generators up to and including the following valves: Main Steam Relief Valves NMS-PCV-466,476,486,496,467,477,487,497,468,478,488,498, have similar classification designations as those for the main steam piping including the branch pipe from the steam generators up to and including the following valves: Main Steam Relief Valves NMS-PCV-465,475,485,495.
In addition the staff noted that none of the main steam relief valves are listed as containment isolation barriers associated with valve arrangement sheet 15 items in Table 6.2.4-3. Indicate if these valves should be added to Table 6.2.4.3 as containment isolation barriers.

06.02.04-26

6.2.4-26
Clarify if portions of the Emergency Feedwater system meet GDC 4 criteria.

Pursuant to GDC 4 with regard to the designation of structures systems and components important to safety which are designed to withstand the effects of and withstand the environmental conditions associated with postulated accidents, confirm if the Emergency Feedwater discharge piping to the steam generators from and excluding the emergency feedwater system containment isolation valves EFS-MOV-019A,B,C,D ,has similar classification designations as those listed in table 3.3-2 for the Main feedwater piping and valves to the steam generators from and including the main feedwater isolation valves NFS-VLV-512A,B,C,D.

06.02.04-27

(6.2.4-27)
Clarify if portions of the VWS system meet GDC 4 criteria.

Pursuant to GDC 4 with regard to the designation of structures systems and components important to safety which are designed to withstand the effects of and withstand the environmental conditions associated with postulated accidents, and pursuant to SRP 6.2.4 subsection II Acceptance Criterion #15, confirm that the Chilled Water System (VWS) piping and valves from the VWS containment isolation valve VWS-MOV-403, through the CRDM Cooling Units in containment, up to and including VWS containment isolation Valve VWS-MOV-40, is designed to the following criteria:
The system is protected against missiles and pipe whip.
The system is designated seismic Category I.
The system is classified Quality Group B.
The system is designed to withstand temperatures equal to at least that of the containment design.
The system is designed to withstand the external pressure from the containment structure acceptance test.
The system is designed to withstand the LOCA transient and environment.

06.02.04-28

(6.2.4-28)
Illustrate missile barrier in figure 6.2.4.1

Pursuant to the evaluation of GDC-4, in accordance with ANSI N271-976 appendix B guidance, show the relationship between the missile barrier and the containment isolation barrier for each containment isolation configuration shown in figure 6.2.4.1

06.02.04-29

(6.2.4-29)
Provide information on leak detection capability in remote manual systems.

As discussed in section 6.2.4.2, you state that the US-APWR design provides means of detection of possible leakage from lines where remote manual valves are acceptable and employed. Additional details on these provisions are required in order to demonstrate the acceptability of meeting the requirements of GDC 54 as it relates to the ability to detect leakage from, identify and isolate these lines. Provide details of leakage detection capability for each system needed for safe shutdown of the plant listed in table 6.2.4-3 that utilizes remote manual valves for containment isolation. Details of such provisions can include (but are not limited to) a description of instrumentation for measuring system flow rates or pressure , temperature, radiation or water level in areas outside the containment like valve rooms or engineered safeguards areas.

06.02.04-30

(6.2.4-30)
Provide information on provisions to alert the operator to isolate RM systems.

In order to evaluate if requirements of GDC 54 as they relate to reliable isolation capability systems utilizing remote manual containment isolation valves have been met for the US-APWR, more information is required. For each containment penetration listed in table 6.2.4-3 that is equipped with remote manual containment isolation valves, provide details as to what provisions are provided to alert the operator of the need to isolate fluid systems equipped with remote manual isolation valves. Such provisions may include instruments to measure flow rate, sump water level, temperature, pressure, and radiation level. For each penetration and provision (instrument(s)) listed, provide a description of how an operator in the main control room would use the provision or instrument to identify the line and to determine when to isolate the fluid system.

06.02.04-31

(6.2.4-31)
Provide a table describing the provisions for individual leakage rate testing of the isolation barrier.

In order to evaluate if requirements of GDC 54 as they relate to the ability to test the operability of isolation barriers are met and to determine if valve leakage is within acceptable limits, for each containment isolation barrier, provide a table describing the provisions (test connection etc) for individual leakage rate testing of the barrier.

06.02.04-32

(6.2.4-32)
Clarify use of resilient seals on containment vent and purge valves and accommodations for seal replacement if supplied.

In order to evaluate if requirements of GDC 54 as they relate to the ability to test the operability of isolation barriers and to determine if valve leakage is within acceptable limits, specify (or state where in the DCD it is specified) if the containment purge and vent valves will be supplied with resilient seals. If supplied, specify what accommodations are provided for resilient seal replacement when required by leakage rate testing or manufacturer recommendation.

06.02.04-33

(6.2.4-33)
Provide information on evaluation of isolation valve seal systems

Table 6.2.4.1, "Design Information Regarding Provisions for Isolating Containment Penetrations" refers to an isolation valve seal system. There is no reference to such a system elsewhere in the DCD. It is unclear if an isolation valve seal system will be provided as part of the design. Clarify if such system is provided. If it is, please submit an evaluation of the functional capabilities of the system.

06.02.04-34

(6.2.4-34)
Clarify possible Typo.

GDC 55 as described in section 3.1.5.6 may have a typographical error. It appears that item #2 is the same as item #1 in the paragraph. Item #2 reads: One **locked closed** isolation valve inside and one locked closed isolation valve outside containment; or" Confirm that #2 should read: "One **automatic** isolation valve inside and one locked closed isolation valve outside containment; or"

06.02.04-35

(6.2.4-35)
In table 6.2.4.1, "Design Information Regarding Provisions for Isolating Containment Penetrations" For Valve Operability and Qualification, References "N278.1-1995", NRC staff could not locate this reference. Please indicate if this is in fact ASME N278.1-1975?

06.02.04-36

(6.2.4-36)
In order to evaluate the Containment Isolation System design as it relates to meeting the requirements of 10 CFR 50 Appendix A(1), consideration of the need to design against single failures of passive components in fluid systems important to safety, more information is required. There is no failure modes and effects analysis of the CIV system provided. In accordance with RG 1.206 C.I.6.2.4.3 guidance, please provide a failure modes and effects analysis.