KHNPDCDRAIsPEm Resource

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Sent: Thursday, May 12, 2016 10:23 AM
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Cc: Le, Hien; Dias, Antonio; Umana, Jessica; Williams, Donna
Subject: APR1400 Design Certification Application RAI 481-8546 (16 - Technical Specifications)
Attachments: APR1400 DC RAI 481 SPSB 8546.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the following RAI question response times. We may adjust the schedule accordingly.

16-143: 45 days
16-144: 30 days
16-145: 45 days
16-146: 45 days
16-147: 45 days
16-148: 45 days
16-149: 45 days
16-150: 45 days
16-151: 45 days
16-152: 45 days

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

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REQUEST FOR ADDITIONAL INFORMATION 481-8546

Issue Date: 05/12/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 16 - Technical Specifications
Application Section: 16.3.4, 16.3.5, 16.3.6, 16.3.7, 16.3.9

QUESTIONS

16-143

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, "Standard Technical Specifications-Combustion Engineering Plants," Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicanhis request stems from discussion at the February 2016 meeting with the applicant.

In generic TS LCO 3.4.14, the applicant elects to include OPERABILITY of the containment atmosphere humidity monitor, which provides information about the containment atmosphere moisture content, and may "qualitatively" indicate the possibility of RCS LEAKAGE, in addition to the quantitative monitors for containment sump level and atmosphere particulate radioactivty. The gaseous radioactivity monitor specified in STS 3.4.15 is considered to be a qualitative RCS leakage monitor based on the guidance in Regulatory Guide (RG) 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage," Revision 1.

The applicant is requested to address the following differences between the STS and the generic TS and Bases:

1. Condition A should say "Required containment sump (level) monitor inoperable" instead of "One or more required channel(s) inoperable"; Required Action A.2 should say "Restore required containment sump (level) monitor to OPERABLE status." with a completion time of 30 days.

2. Condition B should say "Required containment atmosphere radioactivity (particulate) monitor inoperable." Required Action B.2.1 should say "Restore required containment atmosphere radioactivity (particulate) monitor to OPERABLE status." with a completion time of 30 days.

3. Delete Required Action B.2.2, since it duplicates Required Action B.2.1, and an inoperable sump (level) monitor is the subject of Condition A (as pointed out in sub-question 1 above).

4. Condition C should say “Required containment atmosphere humidity monitor inoperable.” Renumber Required Action C.2 as C.2.1, insert logical connector “AND” after Required Action C.2.1; and add Required Action C.2.2 which says "Restore required containment atmosphere humidity monitor to OPERABLE status." with a completion time of 30 days.

5. Delete Condition D Note, which says “Only applicable when the containment atmosphere gaseous radiation monitor is the only OPERABLE monitor.” The gaseous radiation monitor is not listed in the LCO 3.4.14 statement.

6. Condition D should say “Required containment sump (level) monitor inoperable. AND Required containment atmosphere humidity monitor inoperable.” Revise Required Actions D.1 and D.2 to be similar to Required Actions E.1 and E.2 for Condition E, given that another quantitative monitor remains OPERABLE (that is, the containment atmosphere radioactivity (particulate) monitor).

7. Add a new Condition F for "Required containment sump (level) monitor inoperable. AND Required containment atmosphere radioactivity (particulate) monitor inoperable." with Required Actions and 7 day Completion Times similar to STS 3.4.15 Condition D for the situation where only a qualitative monitor remains OPERABLE (that is, the required containment atmosphere humidity monitor). Renumber Conditions F and G as Conditions G and H. Required Actions for new Condition F should say: “F.1 Restore required containment sump (level) monitor to OPERABLE status. | 7 days OR F.2 Restore required containment radioactivity (particulate) monitor to OPERABLE status. | 7 days”

8. Revise the phrase “of the required containment … monitor” in all SR statements. Add “(particulate)” after “radioactivity”, and “(level)” after “sump” in all locations in generic TS Subsection 3.4.14 and Bases Subsection B 3.4.14 when referring to the quantitative leakage monitors of the RCS leakage detection instrumentation required by LCO 3.4.14.

9. Revise Subsection B 3.4.14 to reflect not only the above changes, but also the inclusion of the containment humidity monitor as an LCO required monitor.

10. Generic TS SR 3.4.14.1 says, “Perform CHANNEL CHECK of required containment atmosphere radioactivity monitor.” If only one radioactivity particulate monitor channel is required, how is this surveillance accomplished?

11. Justify not providing an SR to perform a CHANNEL CHECK of the required containment atmosphere humidity monitor.

16-144

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, “Standard Technical Specifications-Combustion Engineering Plants,” Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion

Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicant.

The applicant is requested to make the following corrections to generic TS 3.7.11 and Bases:

1. The Note below the Subsection title of Specification 3.7.11, “Control Room HVAC System (CRHS)” is not appropriate for the Specification; put this design detail in the Bases Background section. The inclusion of this Note is not described on STS Deviation Report (DR) page 105. The Note states: “The CRHS consists of two divisions of control room emergency makeup air cleaning system (CREACS) and control room supply and return system (CRSRS).”

2. “HVAC” needs to be defined whenever first used in each Specification and Bases subsection.

3. LCO 3.7.11 in generic TS rev. 0 states, “Two CRHS divisions shall be OPERABLE.” but DR page 106 quotes LCO 3.7.11 as “The CRHS shall be OPERABLE with: *a. Two CREACS divisions OPERABLE; and* b. Two AHUs in two CRSRS divisions OPERABLE.” (Text in italics is a guess.)

4. Modify the phrase in SR 3.7.12.4 as indicated: “...can be maintained at a **pressure of** ≤ -6.35 mm (-0.25 inches) water gauge with respect to the adjacent areas...”

5. Change the 92 day completion time of generic TS 3.7.11 Required Action B.3 to 90 days, since the completion time of 90 days was the result of staff-industry negotiation approved in TSTF-448-A, Rev. 3.

16-145

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, “Standard Technical Specifications-Combustion Engineering Plants,” Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicanhis request stems from discussion at the February 2016 meeting with the applicant.

The applicant is requested to correct the design certification application where the generic TS provision language quoted in the STS Deviation Report does not match the actual language in Revision 0 of the generic TS:

1. Generic TS SR 3.4.2.1 Frequency is missing the 12 hour Frequency, which is included in the Deviation Report. Also, the 12 hour Frequency should be second, not third, since only the last Frequency may have a Note, per TSTF-GG-05-01 Paragraph 4.1.7.e. But that conflicts with the convention to have Frequencies listed from smallest interval to largest interval. The applicant is requested to remove the Note and state the 30 minute Frequency as "30 minutes with the reactor critical and T_{cold} < 289.4 °C (553 °F)".

2. Generic TS 3.4.4, "RCS Loops - MODES 1 and 2," LCO 3.4.4 states, "Two RCS loops shall be OPERABLE and in operation with two reactor coolant pumps operating in each loop." The Deviation Report states it as "Two RCS loops shall be OPERABLE and two reactor coolant pumps in each loop shall be in operation." The applicant is requested to correct the Deviation Report.

3. Generic TS 3.4.10, "POSRVs," the Applicability is missing the Note stated in the Deviation Report.

4. (See RAI-Question 16-23 Subquestion 18, RAI 119-7976, Question 27125) Generic TS 3.9.5, "Shutdown Cooling System (SCS) and Coolant Circulation – Low Water Level," does not contain Required Action B.4 which is included in the Deviation Report. Revise Required Action B.4 as indicated: "B.4 Initiate actions to ~~make~~ **place** the containment building penetrations in the ~~required~~ status ~~as~~ **specified** in LCO 3.6.7**, "Containment Penetrations - REDUCED RCS INVENTORY Operations."** | Immediately". (Note that this provision may be affected by resolution of a concern about the definition of REDUCED RCS INVENTORY.)

16-146

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, "Standard Technical Specifications-Combustion Engineering Plants," Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicant.

REQUEST FOR ADDITIONAL INFORMATION 481-8546

1. STS Revision 4 provisions equivalent to generic TS Revision 0 provisions are not correctly identified in Deviation Report:

   a. STS 3.4.10, "Pressurizer Safety Valves," does not contain a SR equivalent to SR 3.4.10.1 of generic TS 3.4.10, "POSRVs." However generic TS SR 3.4.10.3 does correspond to STS SR 3.4.10.1. The applicant is requested to correct the Deviation report, which incorrectly depicts STS SR 3.4.10.1 as equivalent to generic TS SR 3.4.10.1.

   b. STS 3.4.11, "Pressurizer Power Operated Relief Valves (PORVs)," is equivalent to generic TS 3.4.16, "Reactor Coolant Gas Vent (RCGV) Function," for the purpose of mitigating a steam generator tube rupture event. The Deviation Report does not show this correspondence. The applicant is requested to correct the Deviation report. In addition, DCD Tier 2 Section 5.4.12 should also include a discussion of the RCGV Function in SGTR mitigation.

2. The applicant is requested to clarify justifications for generic TS differences from STS in the Deviation Report that are not clear, or are invalid, or remove such differences:

   a. Generic TS 3.4.3, "RCS P/T Limits," Applicability contains an exception to "At all times" that is not justifiable and is not consistent with STS 3.4.3. The applicant is requested to remove the proposed exception.

   b. STS 3.4.5, "RCS Loops – MODE 3," LCO 3.4.5 states, "[Two] RCS loops shall be OPERABLE and one RCS loop shall be in operation." The generic TS states LCO 3.4.5 as, "Two RCS loops shall be OPERABLE with steam generators and at least one reactor coolant pump per loop and at least one RCS loop shall be in operation." The proposed LCO statement is confusing, and the justification in the Deviation Report is invalid ("The meaning of the LCO is practically the same."). The applicant is requested to revert to the STS version. Also, ensure the Bases describes what constitutes an operable RCS loop, and the number of operating reactor coolant pumps needed to consider a loop "in operation."

   c. Generic TS 3.4.6, "RCS Loops – MODE 4," LCO 3.4.6 omits the pressurizer water level upper limit for starting a reactor coolant pump. In addition, the generic TS LCO 3.4.6 statement includes the phrase "at least" in "... at least one loop or train shall be in operation." The Deviation Report does not address this difference. LCO 3.4.6 should be consistent with DCD Tier 2 Section 5.2.2.

   d. Generic TS 3.4.10, "POSRVs" alternate Required Action B.2.2 ("<u>OR</u> Be in MODE 4 on shutdown cooling with the requirements of LCO 3.4.11 met.") is not included in STS 3.4.10 Action B; the justification for this difference in unclear. It states, "The REQUIRED ACTIONs reflect the APR1400 design. When the POSRV(s) are inoperable, LTOP relief valves shall be aligned for OPP. Alignment of LTOP relief valves can be allowed by meeting conditions by reducing the cold leg temperature down to the LTOP enable temperature and by opening SCS isolation valves."

16-147

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, "Standard Technical Specifications-Combustion Engineering Plants," Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicant.

In NUREG-1432, "Standard Technical Specifications (STS) Combustion Engineering Plants," Revision 2 (2001) and Revision 3 (2004), STS 3.9.1 Required Action A.1 for the Condition of boron concentration not within limit says "Suspend CORE ALTERATIONS. | Immediately"; and Required Action A.2 says "AND Suspend positive reactivity additions. | Immediately". However, equivalent generic TS 3.9.1 Required Action A.1 only says "Suspend positive reactivity additions. | Immediately", which matches STS 3.9.1, Revision 4 (2012), Required Action A.1 and the changes to STS 3.9.1 Rev. 3, approved in TSTF-471-A, Rev. 1, "Eliminate use of term CORE ALTERATIONS in ACTIONS and Notes," in 2006.

Similarly, in STS Revision 2 (2001) and Revision 3 (2004), STS 3.9.2 Required Action A.1 for the Condition of one startup range [neutron flux] monitor inoperable says "Suspend CORE ALTERATIONS. | Immediately". However, equivalent generic TS 3.9.2 Required Action A.1 says "Suspend positive reactivity additions. | Immediately", which matches STS 3.9.2, Revision 4 (2012), Required Action A.1 and the changes to STS 3.9.2 Rev. 3, also approved in TSTF-471-A, Rev. 1, in 2006.

Since the generic TS Section 1.1 retains the definition of CORE ALTERATION, which includes movement of irradiated fuel assemblies in containment, and because it is prudent to suspend positive reactivity additions without one of the two required startup range neutron flux monitors, the applicant is requested to modify Action A of generic TS 3.9.1 and 3.9.2 to require immediate suspension of both CORE ALTERATIONS and positive reactivity additions.

The applicant is reminded of RAI-Question 16-43 (RAI 154-8064, Question 27306) regarding TSTF adoption (or non-adoption); the response should address non-adoption of TSTF-471-A, Rev. 1.

16-148

Paragraph (a)(11) of 10 CFR 52.47 and paragraph (a)(30) of 10 CFR 52.79 state that a design certification (DC) applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36 and 50.36a. 10 CFR 50.36 sets forth requirements for technical specifications to be included as part of the operating license for a nuclear power facility. NUREG-1432, "Standard Technical Specifications-Combustion Engineering Plants," Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

This request stems from discussion at the February 2016 meeting with the applicant.

The applicant is requested to explain what the following statement in Deviation Report Section III.2.2.2 means: "In the APPLICABILITY section[of Specification 3.4.10], the 72 hours exception is based on 18 hours of outage time for each of the four valves (APR1400 adopts 4 POSRVs). The 18-hour period is determined based on operating experience."
The "72 hours exception" is stated in the following 3.4.10 Applicability Note:

> The **POSRV** opening time ~~measurement~~ and lift pressure setting ~~of POSRV~~ are not required to be within LCO limits during MODES 3 and 4 for the purpose of setting the POSRVs under ambient (hot) conditions. This exception is allowed for 72 hours following entry into MODE 3 provided a preliminary cold setting was made prior to heatup.

It appears that since 4 times 18 is 72, the total time spent in MODE 3 to "set" the four POSRVs is 72 hours. In addition, does the phrase "provided a preliminary cold setting was made prior to heatup" imply that the cold setting must be completed in MODE 5 before entry into MODE 4? And how does the "cold setting" ensure RCS overpressure protection in MODES 3 and 4 before performance of SR 3.4.10.3? Should there be a "cold setting" SR with its own acceptance criteria for lift setting pressure and opening time?

The statement of SR 3.4.10.3 appears to be incorrect. The within ± 1.50% of lift pressure setpoint is the operability acceptance criterion of the as-found lift pressure setting. In all

performances of this SR, the pilot valves must be adjusted so that the as-left lift pressure setting is within ± 0.75% of lift pressure setpoint. See markup of SR 3.4.10.3 below.

Does "within 0.5 seconds" mean "< 0.5 seconds" or "≤ 0.5 seconds"? Use the appropriate symbol instead of "within" to clarify the POSRV opening time acceptance criterion.

The applicant is requested to explain the phrase "including dead time" in the Bases for SR 3.4.10.1, where indicated in the below markup.

However, the above Note, SR 3.4.10.3, and the Bases for SR 3.4.10.3 need editorial improvements, as indicated in the above and below markups. The applicant should correct any inaccuracies that may have been introduced in the suggested edits.

SR 3.4.10.3	~~Verify~~ **For** each pressurizer POSRV ~~meets the following~~: a. **Verify** ~~The~~ lift **pressure** setting~~s~~ of **each of the** two spring-loaded pilot valves ~~are~~ **is** ≥ 171.1 kg/cm^{2}A (2,433 psia) and ≤ 176.3 kg/cm^{2}A (2,507 psia). **b.** Adjust **each spring-loaded pilot valve, as necessary, so that the** lift **pressure** setting~~s to within limits if lift setting pressure~~ **is** ≥ 172.4 kg/cm^{2}A (2,451.4 psia) and ≤ 175.0 kg/cm^{2}A (2,488.5 psia). ~~b~~**c.** **Verify o**pening time of pressurizer POSRV **is** ~~shall be within~~ **≤** 0.5 seconds, including dead time.	18 months

SR 3.4.10.3

Surveillance Requirements ~~is~~ **are** specified for **verifying** the **pressurizer POSRV** lift **pressure** settings and **POSRV** opening time ~~of pressurizer POSRVs~~. The allowable range of ~~LCO to meet~~ **the as-found** lift **pressure** setting~~s of POSRVs set~~ **of each POSRV spring-loaded pilot valve is 1.5%** of the valve setpoint ~~to~~ **above the valve setpoint to 1.5% of the valve setpoint below the valve setpoint.** ~~and then~~ **The surveillance requires adjusting** the **as-left lift pressure setting to** ~~valve setpoint is reset~~ within **the allowable range of** 0.75% **of the valve setpoint above the valve setpoint and 0.75% of the valve setpoint below the valve setpoint**. **The specified POSRV opening time of 0.5 seconds or less**

is consistent with the safety analyses. {KHNP to insert statement to explain the phrase "including dead time."}

The POSRV lift pressure setpoint verification and adjustment, and opening time verification are normally performed in MODE 3 during plant heatup following each ~~after~~ refueling**, which is once every 18 months. The** ASME OM Code (Reference 2) ~~permits the~~ **recommends performing the lift pressure setting verification and adjustment every** 5 years **as the necessary** Frequency ~~necessary~~ to satisfy the requirements for lift **pressure** settings of safety **relief** valves. However, the surveillance **to verify** ~~of~~ the **POSRV** lift **pressure** setting and opening time is performed every refueling cycle according to the special requirements of ~~valves~~ **the POSRVs**. If the two spring-loaded pilot valves **of a POSRV** ~~per valve~~ **both** satisfy the requirements of lift setting and opening time, then ~~it~~ **the POSRV** is OPERABLE ~~status~~.

16-149

Follow-up to the responses dated 2/1/2016, to RAI -7975, Question 16-25, Items 4 and 5.

1. The staff considered the response to Item 4 incomplete for the following reason.

   In the original RAI, the staff raised the Item 4 issue as follows:

   > "The TS 3.6.7 Bases do not provide sufficient supporting information with regard to the need for LCO 3.6.7 requirements. The LCO 3.6.7 statement reads almost the same as the one for LCO 3.9.3. Since the scope of "Applicability" for LCO 3.6.7 is different from the one for LCO 3.9.3, the staff expects to see a change to LCO 3.6.7.c.1 with respect to the term "equivalent " used in LCO 3.9.3 to mean "a HVAC or vapor barrier" which is not capable to support a pressurized containment condition as shown in the low-power-and-shutdown (LPSD) analysis. The applicant is requested to address the above staff's concerns and revise TS 3.6.7 and its associated bases accordingly."

   In the response the applicant provided the following information:

   > "The closure of a containment penetration during reduced inventory operations requires different design criteria than during refueling operations. Since the explained term of equivalent in LCO 3.9.3 for refueling operations may not be adequate for reduced inventory operations, that alternative for isolation will be deleted from Technical Specification 3.6.7 as indicated in Attachment 4. Unlike the Bases for LCO 3.9.3, the Bases for 3.6.7 does not include clarification for the term 'equivalent' and, therefore, no change to the Bases for 3.6.7 is necessary."

   The applicant is requested to revise the Background section of the Bases for TS 3.6.7 to include a discussion of operating experiences of currently operating PWR plants during Mid-Loop operations as documented in Generic Letter (GL) 88-17, "Loss of Decay Heat Removal."

2. The staff found the response to RAI-Question 16-25, Item 5 acceptable; however, the applicant is requested to address additional questions related to the proposed requirements of generic TS Subsections that apply during the shutdown condition of REDUCED RCS INVENTORY (RCS level < 127 ft ¼ in). For each Subsection, the MODE 5 and MODE 6 applicabilities are listed.

   - 3.4.8, "RCS Loops – MODE 5 (Loops Not Filled)," Required Action B.3

     Applicability: MODE 5 with RCS loops not filled.

     (RCS highest elevation is top of SG tubes, which is an RCS Level of 162 ft 4.2 in.)

   - 3.5.3, "Safety Injection System (SIS) – Shutdown"

     Applicability: MODE 5,

     MODE 6 with RCS level < 130 ft 0 in.

     (RCS level of 130 ft 0 in is ¼ in below top of reactor vessel (RV) flange.)

   - 3.5.4, "In-Containment Refueling Water Storage Tank (IRWST)"

     Applicability: MODE 5,

     MODE 6 with RCS level < 130 ft 0 in.

   - 3.6.7, "Containment Penetrations – REDUCED RCS INVENTORY Operations"

     Applicability: MODE 5 with REDUCED RCS INVENTORY,

     MODE 6 with REDUCED RCS INVENTORY.

     (REDUCED RCS INVENTORY corresponds to an RCS level of 127 ft ¼ in.)

     (RCS level of 127 ft ¼ in corresponds to 3 ft below top of RV flange.)

   - 3.9.5, "Shutdown Cooling System (SCS) and Coolant Circulation – Low Water Level"

     LCO 3.9.5.a

     Applicability: MODE 6 with the water level < 23 ft above the top of RV flange.

     (Refueling pool level of 23 ft above top of RV flange is an elevation of 153 ft ¼ in.)

     LCO 3.9.5.b

     Applicability: MODE 6 with REDUCED RCS INVENTORY.

   In Technical Report (TR) APR1400-E-N-NR-14005-P, "Shutdown Evaluation Report," Appendix A, "Procedural Guidance to Support Reduced Reactor Coolant System Inventory Operations," the applicant identifies the following high-risk scheduled maintenance activities that are performed when the RCS water level is maintained at lower than the elevation mark for "REDUCED INVENTORY" (3 ft below the top of the reactor vessel flange):

   - Installation and removal of steam generator (SG) cold leg nozzle dams
   - Installation and removal of SG hot leg nozzle dams
   - Reactor Coolant Pump (RCP) seal housing removal and installation
   - DVI nozzle 2A or 2B valve maintenance

   The staff also considers as high-risk the removal and the re-installation of the RV head and installation activities that are performed when the RCS water level is maintained at slightly

below the reactor vessel flange. Due to the estimated short time period following a loss of shutdown cooling (decay heat removal) until the reactor coolant in the RV begins to boil (time-to-boil) when RCS inventory is less than normal (MODE 5 with RCS loops not filled, or MODE 6 with refueling pool level < 23 ft above RV flange), the requirements of the above LCOs may need to be applicable at an RCS water level > 127 ft ¼ in, the REDUCED RCS INVENTORY elevation threshold, and even an RCS water level > 130 ft ¼ in; i.e., above the top of the RV flange, to adequately address the safety concerns of GL 88-17.

The applicant is requested to consider the following recommendations:

A. Remove the definition of REDUCED RCS INVENTORY from generic TS Section 1.1.

B. Instead of using "REDUCED RCS INVENTORY," use the associated elevation threshold value of 127' ¼" in generic TS Subsections 3.4.8, 3.5.3, 3.5.4, 3.6.7, 3.9.3, and 3.9.5; and associated Bases subsections. Suggest renaming Subsection 3.6.7 to "Containment Penetrations – Shutdown." Also, please either consistently use, or do not use, "EL" when referring to an RCS water level in terms of height above the reference level (or elevation); this is a global comment for the entire DCD Chapter 16.

C. Since Subsection 3.4.8 attempts to address concerns about the risk of activities involving low RCS water level conditions in MODE 5, it is logical to provide default action requirements in the event the SCS requirements of LCO 3.4.8 are not met and the actions to restore compliance with LCO 3.4.8 are not met. Therefore, the applicant is requested to consider the following changes to the Actions table of Subsection 3.4.8.

Note that these suggested changes are the staff's attempt to craft action requirements to

- Limit the time that low inventory conditions are permitted with no shutdown cooling flow through the core to avoid onset of boiling in the core while in mid-loop operation;
- Allow reasonable time to recover from a maintenance activity during mid-loop conditions (e.g., complete installation of nozzle dams or close the steam generator manway) and establish an intermediate reactor vessel level, such as > 127 ft ¼ in., following a loss of shutdown cooling, to increase the time to core uncovery; and
- If shutdown cooling is not restored, require initiating action to increase level until RCS loops are filled, which exits the MODE of applicability for Specification 3.4.8; or transitioning to MODE 6 and raising level to 23 ft above the top of the reactor vessel flange, which also exits the MODE of Applicability for Specification 3.4.8.

The applicant is requested to identify appropriate completion times for the suggested action requirements, and explain why those times are acceptable. The staff considers the below completion times are for illustration only, and do not constitute their approval by the staff.

Suggested changes to action requirements for Generic TS Subsection 3.4.8:
ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME

A. One SC train inoperable.	A.1 ~~Initiate action to restore~~ Restore SC train to OPERABLE status. **AND** **A.2 Raise RCS level to > 39.7 m (130 ft 0 in).**	**4 hours**~~Immediately~~ **4 hours**
B. Two SC trains inoperable. OR No SC train in operation.	B.1 Suspend ~~all~~ operations ~~involving reduction of~~ **that would cause introduction of coolant into the** RCS **with** boron concentration **less than required to meet SDM of LCO 3.1.1**. AND B.2 ~~Initiate action to restore~~ **Restore** one SC train to OPERABLE status and operation. AND B.3 ~~Initiate action to raise~~ **Raise** RCS level to > **39.7 m (130 ft 0 in)** ~~EL 38.72 m (127 ft 1/4 in)~~.	Immediately **1 hour**~~Immediately~~ **1 hour**~~Immediately~~

C. Core outlet temperature > 57.2°C (135°F) with RCS level ≤ 38.72 m (127 ft 1/4 in). **OR** **RCS level ≤ 38.72 m (127 ft 1/4 in) with < 96 hours since reactor was last critical.**	**C.1 Restore core outlet temperature to ≤ 57.2°C (135°F).** **AND** **C.2 Raise RCS level to > 38.72 m (127 ft 1/4 in).**	**1 hour** **2 hours**
D. Required Action and associated Completion Time not met.	**D.1 Initiate action to comply with LCO 3.4.7, "RCS Loops – MODE 5 (Loops Filled)."** **OR** **D.2 Initiate action to be in MODE 6 and comply with LCO 3.9.4, "SCS and Coolant Circulation – High Water Level."**	**Immediately** **Immediately**

D. Revise generic TS 3.4.8 LCO Notes, by adding Note 4, which states:

---NOTE**S**-------------------------------------
-

4. RCS level ≤ EL 38.72 m (127 ft 1/4 in) is allowed if the time since the reactor was last critical is ≥ 96 hours and core outlet temperature is maintained ≤ 57.2°C (135°F).

This proposed Note 4 is meant to replace a change to the Subsection 3.4.8 Applicability statement proposed by the applicant in response to **RAI 232-7864 - Question 19-6**,

which added the following sentence in parenthesis to “MODE 5 with RCS loops not filled.”

> MODE 5 with RCS loops not filled (Mid-loop operation shall be started at least 4 days after shutdown and equal to or less than 57.2°C (135°F of initial hot leg temperature.)

The applicant’s proposed restrictions on elapsed time after shutdown and initial hot leg temperature for initiating mid-loop operation (RCS level ≤ 119 ft 1 in) do not belong in the Applicability statement, but should be a part of the LCO statement in the form of an LCO Note. Using the REDUCED RCS INVENTORY level elevation threshold instead of the (~ 8 feet lower) level elevation at the top of the hot leg junction with the reactor vessel, as the water level entry condition in Note 4, is more consistent with Required Action B.3. Use of “core outlet temperature” instead of “hot leg temperature” is preferred because it is consistent with Note 1.a.

In addition, replace generic TS LCO 3.4.7 Note 1.a and LCO 3.4.8 Note 1.b with the language of the equivalent Notes in STS LCO 3.4.7 and LCO 3.4.8:

> No operations are permitted that would cause introduction of coolant into the RCS with boron concentration less than required to meet the SDM of LCO 3.1.1; and

The applicant is also requested to make appropriate conforming changes to the Bases.

E. Since a reactor coolant temperature of ≤ 57.2°C (135°F) is a condition for reducing reactor vessel level to ≤ 119 ft 1 in, there needs to be a corresponding Condition in the Actions table of Subsection 3.4.8; for example, see Condition C in the above suggested Actions table in Question item 2.C.

There also needs to be a corresponding surveillance in the Surveillance Requirements table of Subsection 3.4.8; for example, insert the following SR and renumber SR 3.4.8.2 and SR 3.4.8.3 as SR 3.4.8.3 and SR 3.4.8.4:

SURVEILLANCE		FREQUENCY
SR 3.4.8.2	--------------------------------NOTE------------------------------ Only required to be met when RCS level is ≤ EL 38.72 m (127 ft 1/4 in). --- Verify core outlet temperature is ≤ 57.2°C (135°F).	12 hours

The applicant is also requested to make appropriate conforming changes to the Bases for Subsection 3.4.8.

F. The applicant is requested to consider using the RCS level corresponding to just below the reactor vessel flange (130 ft) in place of the level of 127 ft 1/4 in, as proposed in the above suggested LCO 3.4.8 Note 4 (item 2.D) and Required Actions A.2, B.3, and C.2

(item 2.C) because of the resulting greater reactor vessel water volume to mitigate a loss of decay heat removal event.

G. Suggest renaming generic TS Subsection 3.6.7 to "Containment Penetrations – Shutdown"; also, revise Subsection 3.6.7 Applicability statement to say:

MODE 5 with RCS loops not filled,
MODE 6 with the water level < 7.0 m (23 ft) above the top of reactor vessel flange.

H. Revise the generic TS 3.5.3, "SIS – Shutdown," Applicability statement to say:

MODES 4 and 5,
MODE 6 with ~~RCS level < 39.7 m (130 ft 0 in)~~ **water level < 7.0 m (23 ft) above the top of reactor vessel flange.**

Likewise, revise the required action that requires increasing water level to 0.25 inches below the RV flange (130 ft) to require increasing water level to 23 ft above the top of the RV flange.

I. Judging by the required actions, it appears that Condition B of Specification 3.5.3 is really only meaningful with the unit initially in MODE 6; therefore it is suggested that the applicant revise the actions consistent with the suggested ACTIONS table below, and with the revised applicability as suggested in item 2.H above.

With the unit in MODE 4, if LCO 3.5.3 is not met and no required SIS train is restored to operable status within 1 hour per Required Action A.1, the expected remedial action seems to be placing the unit in MODE 5 within 37 hours per LCO 3.0.3. In MODE 5, the shutdown cooling and LTOP operability requirements of LCO 3.4.7, 3.4.8, and 3.4.11 must be met. However, LCO 3.5.3 is still not met, and since LCO 3.0.3 provides no additional action, what additional remedial measures should be specified? The applicant is requested to revise the actions consistent with the suggested ACTIONS table below.

The applicant is requested to identify appropriate completion times for the suggested action requirements, and explain why those times are acceptable. The staff considers the below completion times are for illustration only, and do not constitute their approval by the staff.

Suggested changes to LCO and action requirements for Generic TS Subsection 3.5.3:

LCO Two ~~trains of~~ SIS **trains** shall be OPERABLE and diagonally oriented with respect to reactor vessel.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. **One** ~~R~~required SIS train inoperable.	A.1 Restore required SIS train to OPERABLE status.	**6 hours** ~~1 hour~~
		~~Immediately~~

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~B. Required Action and associated Completion Time of Condition A not met.~~	~~B.1.1 Verify RCS level ≥ 39.7 m (130 ft 0 in).~~ ~~OR~~ ~~B.1.2 Initiate actions to restore RCS level to ≥ 39.7 m (130 ft 0 in).~~ ~~AND~~ ~~B.2 Reduce RCS cold leg temperature to < 57.2°C (135°F).~~	~~Immediately~~ ~~24 hours~~
B. Two required SIS trains inoperable.	**B.1 Restore one required SIS train to OPERABLE status.**	**1 hour**
C. Required Action and associated Completion Time of Condition A or B not met in MODE 4.	**C.1 Be in MODE 5.** **AND** **C.2 Reduce RCS cold leg temperature to < 57.2°C (135°F).**	**24 hours** **24 hours**
D. Required Action and associated Completion Time of Condition A or B not met in MODE 5 with RCS loops filled.	**D.1 Reduce RCS cold leg temperature to < 57.2°C (135°F).**	**24 hours**

Generic TS Subsection 3.5.3:
ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
E. Required Action and associated Completion Time of Condition A or B not met in MODE 5 with RCS loops not filled.	**E.1**	**Initiate actions to restore unit to RCS loops filled condition.**	**Immediately**
	AND		
	E.2	**Reduce RCS cold leg temperature to < 57.2°C (135°F).**	**24 hours**
F. Required Action and associated Completion Time of Condition A **or B** not met **in MODE 6**.	**F.1**	**Initiate actions to restore water level to ≥ 7 m (23 ft) above the top of reactor vessel flange.**	Immediately
	AND		
	F.2	**Reduce RCS cold leg temperature to < 57.2°C (135°F).**	24 hours

J. Two manual SIS actuation Function divisions need to be OPERABLE to support the two required SIS trains in MODES 5 and 6. This is Function 1.d, SIAS Manual Trip of GTS Table 3.3.6-1. It may also include Function 7.a, Diverse Manual ESF Actuation

K. Regarding generic TS Subsections 3.4.7 and 3.4.8, the Bases do not explain what constitutes the RCS loops filled condition and RCS loops not filled condition. Do the means of satisfying LCO 3.4.11, LTOP, (either using SC system operable suction relief valves, or an operable RCS vent flow path) enter into this explanation? That is, can the RCS be open (e.g., a vent fow path) and still be in the RCS loops filled condition?

L. Revise the generic TS 3.5.4, "In-Containment Refueling Water Storage Tank (IRWST)," Applicability statement to say:

MODES 1, 2, 3, 4, and 5,
MODE 6 with ~~RCS level < 39.7 m (130 ft 0 in)~~ **water level < 7.0 m (23 ft) above the top of reactor vessel flange.**

Likewise, revise the Action that requires increasing water level to 0.25 inches below the RV flange (130 ft) to either require restoring the unit to the RCS loops filled condition (if in MODE 5) or increasing refueling pool water level to 23 ft above the top of the RV flange (if in MODE 6), as follows.

Suggested additions to action requirements for Generic TS Subsection 3.5.4:
ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A or B not met in MODE 5 with RCS loops filled.	**D.1 Reduce RCS cold leg temperature to < 57.2°C (135°F).**	**24 hours**
E. Required Action and associated Completion Time of Condition A or B not met in MODE 5 with RCS loops not filled.	**E.1 Initiate actions to restore unit to RCS loops filled condition.** **AND** **E.2 Reduce RCS cold leg temperature to < 57.2°C (135°F).**	**Immediately** **24 hours**
F. Required Action and associated Completion Time of Condition A **or B** not met **in MODE 6**.	**F.1 Initiate actions to restore water level to ≥ 7 m (23 ft) above the top of reactor vessel flange.** **AND** **F.2 Reduce RCS cold leg temperature to < 57.2°C (135°F).**	Immediately 24 hours

Alternatively, these three Conditions could be replaced with one Condition, as follows:

Alternate suggested addition to action requirements for Generic TS Subsection 3.5.4:

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A or B not met in MODE 5 or 6.	**D.1 Declare safety injection system trains required by LCO 3.5.3 inoperable.**	**Immediately**

M. Revise the generic TS 3.9.5, "SCS and Coolant Circulation – Low Water Level" Required Actions B.3 and D.1 to read "Initiate actions to establish ≥ 7.0 m (23 ft) of water above the top of reactor vessel flange."

16-150

Follow-up to the responses dated 2/19/2016, to RAI 120-7977, Question 16-24 (27123), Subquestions 1, 3, 7 and 14.

1. The staff considered the response to Subquestion 1 incomplete for the following reason.

   In the original RAI, the staff raised the Subquestion 1 issue as follows (with underlined text for emphasis):

   "APR1400 TS Table 3.7.1-2 contains a Note that allows the "as-left" tolerance for the lift setting to be ±3%. In the NUREG-1432, this allowance is discussed in the TS Bases for SR 3.7.1.1, with the ±3% placed in brackets indicating further supporting information to meet ASME Code, Section III, NC 7000 requirements. ASME Code, Section III, NC 7512.2, "Set Pressure Tolerance," states, in part, " … The set pressure tolerance plus or minus shall not exceed the following: 2 psi (15 kPa) for pressures up to and including 70 psi (480 kPa), 3% for pressures from 70 psi (480 kPa) to 300 psi (2 MPa), 10 psi (70 kPa) for pressures over 300 psi (2 MPa) to 1,000 psi (7 MPa), and 1% for pressures over 1,000 psi (7 MPa). The set pressure tolerance shall apply unless a greater tolerance is established as permissible in the Overpressure Protection Report (NC-7200) and in the safety valve Design Specification (NCA-3250)." The applicant is requested to provide a reference to the applicable documents in the TS Bases."

   It should be noted that in the above quotation, the staff made an error when stating the ±3% tolerance is applicable to an "as-left" value. In NUREG-1432, for an "as-found" value the tolerance is ±3%, and for an "as-left" value the tolerance is ±1%. As a result, in the response, the applicant provided the following information:

   > The "as-left" tolerance for the Main Steam Safety Valve lift setting of ±3% stated in TS Table 3.7.1-2 is described in "I-1350 Test Frequency, Classes 2 and 3

Pressure Relief Valves" of the ASME OM Code (Reference 4) and in Part 1, Section 1.3.4.1 "Pressure Relief Valves" of ANSI/ASME OM-1-1987 (Reference 5) which are referenced in the Bases section for SR 3.7.1.1.

The applicant is requested to address the original stated issue given the required ASME Code $\underline{+}$1% tolerance is for MSSV lift setting "as-found" values.

2. The staff found the response to Subquestion 3 acceptable, however, the applicant is requested to correct editorial errors in the proposed change to Subsection B 3.7.5 Background section as indicated in the following markup:

   The **two** auxiliary feedwater (AFW) pumps in each mechanical division take suction from a respective **common** auxiliary feedwater storage tank (AFWST) ~~and have a respective discharge header~~ (LCO 3.7.6)**, each pump with a respective discharge header,** and ~~pump~~ **discharge** to a respective steam generator secondary side through a common AFW **discharge** header, which connects to the steam generator downcomer main feedwater (MFW) piping inside containment.

3. The staff considered the response to Subquestion 7 incomplete in that, for clarification of the need to have all four 100% AFW pumps to be OPERABLE, Subsection B 3.7.5 LCO section should be revised to include a discussion of the following accident scenario, which was presented in the response, with suggested changes for clarity indicated by the markup:

   Assuming a postulated pipe failure concurrent with a single active component failure, four 100 percent capacity pumps are required to be OPERABLE for the AFW system. If one steam generator is not OPERABLE for reactor cooling on an initiating event, the turbine driven pump and the motor-driven pump in that mechanical division are also not OPERABLE due to the respective **inoperable** steam generator. Concurrent with the initiating event, a single active component failure is considered for the turbine-driven pump or the motor driven pump in the other mechanical division. **One AFW pump and the associated SG would remain OPERABLE to provide reactor cooling because of the AFW system design that provides redundant capacity, and motive power that is both independent and diverse. The two 100 percent capacity motor-driven pumps are powered from independent emergency buses and each of the two 100 percent capacity turbine-driven pumps are powered from steam supplied by the respective SG, which provides diversity.** This is accomplished by powering two 100 percent capacity motor-driven pumps from independent emergency buses and by a diverse means of steam supply for the two 100 percent capacity turbine-driven pumps.

   The applicant is requested to include the above clarifying details in the TS Bases.

4. The staff considered the response to Subquestion 14 incomplete for the following reason.

   In the original RAI, the staff raised the Item 14 issue as follows:

   LCO 3.7.16 states "The combination of initial enrichment and burnup of each spent fuel assembly stored in Region II shall be within the acceptable burnup domain of Figure 3.7.16-1 or in accordance with Specification 4.3.1.1.

> The APR1400 TS 3.7.16 provisions and their associated supporting information in the TS Bases are not consistent with guidance in the STS in that complete information regarding NRC-approved documents for the high-density (Region II) storage of the spent fuel assemblies is not provided in either the TS Bases or TS 4.3 provisions. The applicant is requested to address this missing information.

In the response, the applicant provided the following information:

> Only the Region I spent fuel storage racks are designed to store fuel with a discharge burnup in the "unacceptable domain" of Figure 3.7.16-1. Since TS 3.7.16 and its associated Bases reference Specification 4.3.1.1, TS 4.3.1.1.f will be revised to limit new or partially spent fuel assemblies with discharge burnup in the “unacceptable domain” of Figure 3.7.16-1 to only be stored in Region I spent fuel racks.

The staff reviewed the proposed change to TS 4.3.1.1.f, that is presented as follows:

> New or partially spent fuel assemblies with a discharge burnup in the "unacceptable domain" of Figure 3.7.16-1 New or partially spent fuel assemblies with a discharge burnup in the "unacceptable domain" of Figure 3.7.16-1 ~~will be stored in compliance with the NRC-approved specific document containing the analytical methods, title, date, or specific configuration or figure~~ **shall only be stored in Region I spent fuel storage racks.**

This change appears to negate an earlier proposed change in the response to RAI 93-8075, Question 16-1 that was presented as follows:

> New or partially spent fuel assemblies with a discharge burnup in the “unacceptable domain” of Figure 3.7.16-1 will be stored New or partially spent fuel assemblies with a discharge burnup in the “unacceptable domain” of Figure 3.7.16-1 will be stored **only in the Region I of spent fuel storage rack(s)** in compliance with ~~the NRC-approved specific document containing the analytical methods, title, date, or specific configuration or figure~~ **the technical report titled "Criticality Analysis of New and Spent Fuel Storage Racks".**

The applicant is requested to resolve the above discrepancy.

In the response to RAI 93-8075, Question 16-1, the applicant also proposed the following change to TS 4.3.1.1.b:

> $K_{eff} < 1.0$ if ~~fully~~ flooded with unborated water **and $K_{eff} \leq 0.95$ if flooded with borated water at a minimum soluble boron concentration described in the LCO 3.7.15**, which includes an allowance for uncertainties ~~as described in Section 9.1, “Fuel Storage and Handling.”~~;

The staff understands the minimum boron concentration that is credited in the criticality analysis is addressed in Technical Report (TeR) APR1400-Z-A-NR-14001-P, Rev.0, and is applicable only to fuel assemblies stored in Region II storage racks (e.g., mis-loading

of an unirradiated fuel assembly or an insufficient depleted fuel assembly). Therefore, the applicant is requested to consider the following recommendations:

A. Revise the proposed change to TS 4.3.1.1.b to reflect the design criteria for spent fuel storage racks described in DCD Subsection 9.1.1.

B. Add a Figure to Section 4.3 showing the physical lay-out of the spent fuel pool that clearly identifies the locations of Region I and Region II storage racks within the spent fuel pool.

C. Revise the Background section of the Bases for TS 3.7.16 to include a discussion of the minimum boron concentration credited in the criticality analysis that is described in DCD Subsection 9.1.1.

D. Add TeR APR1400-Z-A-NR-14001-P, Rev.0 to the References section of the Bases for TS 3.7.16.

16-151

Follow-up to the response dated 2/5/2016, to RAI 133-7978, Question 16-31 (26973), Subquestion 12.

The staff found the response to Subquestion 12 unacceptable for the following reason.

In the original RAI, the staff raised the Subquestion 12 issue as follows:

> SR 3.9.5.1 does not state the minimum reactor coolant circulating flow of 4150 gpm as in SR 3.9.4.1. The applicant is requested to add this acceptance criterion to SR 3.9.5.1.

In the response, the applicant stated

> [A]ccording to STS NUREG-1432 Rev.4, SR 3.9.5.1 does not state the minimum reactor coolant circulating flow. The minimum reactor coolant circulating flow in low water level operation including REDUCED RCS INVENTORY operation can be provided in operational procedures rather than the TS.

It should be noted that requirements for an explicit numerical value for SC pump flow in the STS SRs 3.4.7.1, 3.4.8.1, 3.9.5.1 and 3.9.6.1 are dependent on specific safety/accident analyses described in FSAR Chapter 5/Chapter 15 to ensure adequate decay heat removal and/or boron mixing, during shutdown modes where no RCP is running, and the SC pump is used to provide coolant circulation through the reactor core. In addition, based on operating experiences during Mid-Loop operations as documented in generic letter (GL) 88-17, “Loss of Decay Heat Removal - 10 CFR 50.54(f),” a flow requirement should also be established to address the air ingestion condition in the hot leg when the RCS water inventory is maintained at the lowest permitted level for SC operation.

DCD Subsection 5.4.7.2, “System Design,” states, in part, “[R]educed inventory including mid-loop operation is necessary for increasing the plant availability. During this operation, the RCS water level is lowered to below the reactor vessel flange. When the RCS water level abnormally decreases, air may be ingested into the shutdown cooling system with the possibility of affecting the SCS. The RCS level is maintained higher than the RCS low water level of 8.3 cm (3.28 inch)

above the loop center, and a SCS flow rate of 14,385 to 15,710 L/min (3,800 to 4,150 gpm) is maintained for decay heat removal and prevention of an air ingestion.“

In Appendix A, “Procedural Guidance to Support Reduced Reactor Coolant System Inventory Operations,” of Technical Report (TeR) APR1400-E-N-NR-14005-P, “Shutdown Evaluation Report,” a minimum SCS cooling flow of "3000 gpm" is specified to ensure adequate decay heat removal during Mid-Loop operations.

The applicant is requested to include in the above listed SRs a minimum flow of “3000 gpm” for the SC pump to ensure adequate decay heat removal and/or boron mixing, and a maximum flow of “4150 gpm” to ensure no occurrence of vortexing in the hot leg or provide justification for not doing so.

In addition, correct the DCD and TeR to reconcile the difference between the above minimum SC flow values of 3800 gpm and 3000 gpm.

16-152

1. Follow-up to the responses dated 1/27/2016, to RAI 289-8215, Question 16-108 (27866), Subquestion 2.

   a. The staff found the response to Subquestion 2 acceptable, however, the applicant is requested to revise the LCO 3.4.11 statement as follows (with deleted text lined-out) to reflect the staff’s recommendations in generic letter (GL) 96-03, “Relocation of the Pressure Temperature Limit Curves and Low Temperature Overpressure Protections System Limits,” regarding use of a reference to the PTLR in place of the specified lift setpoint for the SCS suction line relief valves:

      Two OPERABLE shutdown cooling system (SCS) suction line relief valves with lift settings ~~≤ 37.3 kg/cm2G (530 psig)~~ specified in the PTLR, or

   b. The applicant is requested to include in the Bases an explanation of the following statement at end of replacement for Bases Background section, third paragraph, (Attachment 1 (2/5) of response to Subquestion 2.

      For an RCS vent to meet the specified flow capacity, it requires removing a pressurizer manway that located above the level of reactor coolant, so as not to drain the RCS when open.

2. Discuss whether generic TS 3.4.11 should include a SR to verify that the charging pump flow restrictor limits the flow rate from both charging pumps to the flow of one charging pump. (DR page 73)

   Discuss omission of requirement for SIT isolation in LCO 3.4.11; DR page 73 states:

      SIT operating pressure is 610 psig and SIT discharge cannot pressurize over LTOP limit pressure, 625 psia. It is because RCS pressure can be assumed to be less than 450 psia (SCS cut in pressure), and RCS

volume is larger than SIT. Therefore, there is no need to include SIT isolation in the APR1400 Technical Specification.

This discussion seems inconsistent with LCO 3.4.11.a, which requires SCS suction line relief valves with lift settings ≤ 37.3 kg/cm^2 (530 psig). Explain.

3. Follow-up to the responses dated 1/27/2016, to RAI 289-8215, Question 16-108 (27866), Subquestions 7 and 8. Also related to RAI 119-7976, Question 16-23 (27125), Subquestion 22.

The generic TS 3.4.16 Actions and associated Bases are unclear regarding the basis for separate Condition entry. Staff believes that the basis is the **location** of each pair of vent flow paths (two solenoid operated valves per flow path, two flow paths per location).

And so, the Actions table note would state: "Separate condition entry is allowed for each RCGV flow path location."

In addition, clarify the first paragraph of the Actions section of the Bases by making the suggested changes indicated in the following markup:

> The ACTIONS are modified by a Note ~~which is added to provide clarification~~ **to clarify** that **separate condition entry is allowed for** each **of the two** RCS **reactor coolant** gas vent **flow** path **locations**, ~~of~~ the reactor vessel closure head and the pressurizer steam space ~~allows a separate entry into a Condition~~.

Since the above interpretation is correct, Subsection 3.4.16 needs to be revised to reflect STS Condition phrasing conventions for an Actions table with separate Condition entry allowed.

Since Condition B corresponds to a loss of RCGV function, a Completion Time of 2 hours is more appropriate than 6 hours. Staff suggest clarifying Required Action B.1 to emphasize that each location is treated independently.

Staff also suggests changing "RCGV path" to "RCGV flow path" for consistency with other Specifications' phrasing. This includes SR 3.4.16.2; change "vent paths" to "vent flow paths."

The applicant is requested to revise the LCO and Actions as indicated in the following markup; the applicant is also requested to make conforming changes to the Bases.

LCO 3.4.16 The following RCGV **flow** paths shall be OPERABLE:

a. Two **flow** paths from the reactor vessel closure head to **the** in**-**containment refueling water storage tank (IRWST), and

b. Two **flow** paths from the pressurizer steam space to the IRWST.

APPLICABILITY: MODES 1, 2, 3,

MODE 4 with RCS pressure ≥ 31.6 kg/cm^{2}A (450 psia).

ACTIONS

--NOTE--
-
Separate condition entry is allowed for each RCGV flow path location.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ~~required~~ **or both locations with one** RCGV **flow** path inoperable.	A.1 Restore RCGV **flow** path to OPERABLE status.	72 hours
B. ~~Two required~~ **One or both locations with two** RCGV **flow** paths ~~from the same location~~ inoperable.	B.1 Restore one RCGV **flow** path **in each location** to OPERABLE status.	~~6~~ **2** hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 4 with RCS pressure < 31.6 kg/cm^{2}A (450 psia).	6 hours 12 hours

4. As shown in DCD Figure 5.4.12-1, the vent flow paths to the IRWST from the reactor vessel closure head and the pressurizer steam space also include a common flow path with two solenoid-operated valves RG-V419 and RG-V420 in parallel. These valves are not clearly identified as within the scope of SR 3.4.16.1 (“Cycle each RCGV valve to the fully closed and fully open position.”) and SR 3.4.16.4 (“Verify correct breaker alignment and position indication power available.”). The applicant is requested to revise the Bases to clarify that the scope of SR 3.4.16.1 and SR 3.4.16.4 includes these two solenoid-operated valves, as well as RG-V410, RG-V411, RG-V412, and RG-V413 (the solenoid-operated valves in the two flow paths from the pressurizer steam space), and RG-V414, RG-V415, RG-V416, and RG-V417 (the solenoid-operated valves in the two flow paths from the reactor vessel closure head). Also consider including RG-V418, the solenoid-operated valve in the common vent flow path to the reactor drain tank, within the scope of these SRs.

5. DCD Figure 5.4.12-1 also depicts one locally operated manual valve, RG-V1430, in the common vent flow path, which is downstream of the above two solenoid-operated valves, that also needs to be within the scope of SR 3.4.16.3 (“Verify the locally operated manual isolation valve from the reactor vessel closure head and the locally operated manual isolation valve from the pressurizer are locked in the open position.”). The two locally operated manual isolation valves described in SR 3.4.16.3 are apparently not depicted on DCD Figure 5.4.12-1. The applicant is requested to revise SR 3.4.16.3 and associated Bases to clarify that the scope of SR 3.4.16.3 includes all three of these locally operated

manual isolation valves. Also consider revising DCD Tier 2 Figure 5.4.12-1 to depict the two locally operated manual isolation valves already described in SR 3.4.16.3.

6. Further, the applicant is requested to revise the third paragraph in the Background section of the Bases B 3.4.16 to reflect the RCGV system information described in DCD Subsection 5.4.12, which is listed as Reference 1 in the Reference section of the Bases B 3.4.16. The cited failure modes and effect analysis (FMEA) was not provided in DCD Subsection 5.4.12.

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